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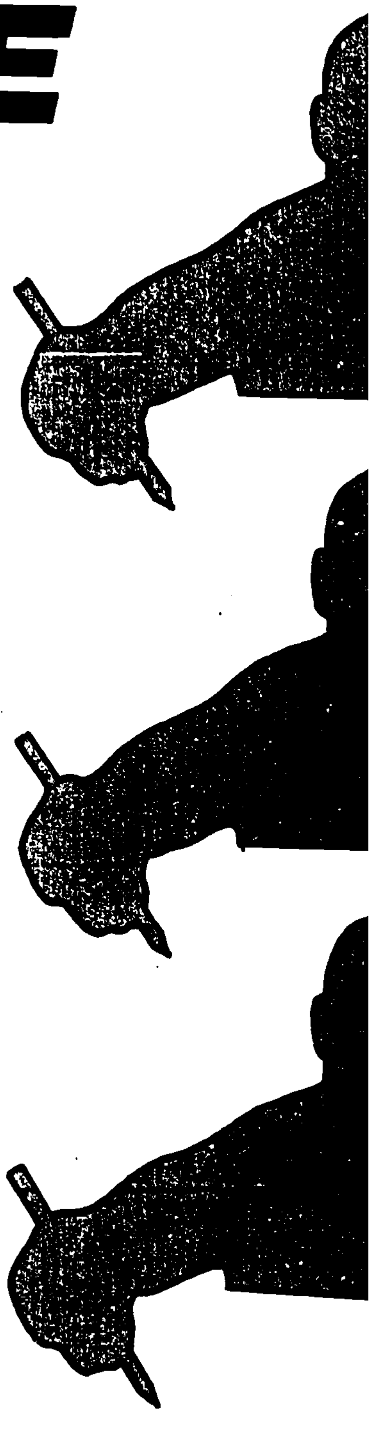
IDENTIFIERS	Dallas Independent School District

ABSTRACT

This document discusses the rationale and the program goals for the K-12 mathematics curriculum for the Dallas Independent School District. Minimum mastery objectives expected of all high school graduates are specified. Mastery objectives for each grade level from K through 8 are listed, and class progress charts are included. The evaluation form for ninth-grade placement, a career planning sheet, a course relationship guide, suggested four-year mathematics programs for grades 9 through 12, and mastery objectives for grades 9 through 12 are provided. A textbook list and chart showing the K-12 continuum of mastery objectives also are included. (DT)

Appendix A

MATHEMATIC
BASELINE



dallas independent school district

K-12 MATHEMATICS PROGRAM

BASELINE

FIELD TEST COPY

dallas independent school district

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FOREWORD

So that parents and students may be aware of what is being taught, teachers can be guided in planning instructional programs, and administrators can provide necessary leadership, facilities and materials, this Baseline is written.

The following curriculum areas were examined during the 1973-74 school year:

Mathematics, science - health, language
arts, social studies, recreative arts,
and creative arts.

During the 1974-75 school year a curriculum effort was initiated to develop a K-12 educational program for Dallas. This educational continuum, called a Baseline, forms the basis for instruction at each level of learning and is not a teaching manual, but a framework of learning expectations. A first step in this effort was the development of a tentative Baseline to which teachers, administrators, consultants, and community members made contributions.

The result of this input is this field test Baseline which will be implemented during the 1975-76 school year. In June, 1976 it is intended that feedback will be processed so that the Baseline framework may be improved to the extent that it may become the foundation for all instruction in the D.I.S.D. for the succeeding three years.

The field test Baseline will be followed by other publications which will state instructional objectives and activities for each learning level and area.

Nolan Estes

3700 Ross Avenue, Dallas, Texas 75204, 214/824-1620

CONTENTS

RATIONALE

OPERATIONS AND THEIR PROPERTIES

NON-METRIC GEOMETRY

Compare, identify, describe geometric figures, lines, planes, and solids.

Ex.

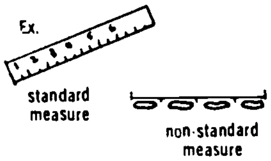
MATHEMATICAL SENTENCES

Ex. $5\frac{1}{4}+2\frac{3}{4}=8$

MEASUREMENT

Measurement using various standard and non-standard measures.

Ex.



NUMBER AND NUMERATION DEVELOPMENT

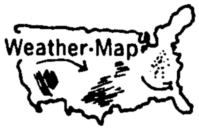
Develop the decimal numeration system.

Ex.

0, 1, ½, .25, π

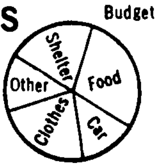
STATISTICS AND PROBABILITY

Ex.



Chance of rain on Wed. = 50%

CHARTS, GRAPHS AND TABLES



Ex.

Interpret and use charts, graphs, and tables.

RATIONALE

The past two decades have been described as a period of vast changes in the teaching of mathematics throughout the nation as well as in Dallas. With these changes came new challenges, one of which was to provide a district - wide program with common goals and objectives designed to meet the needs of all Dallas students.

A K-12 basic mathematics program was developed emphasizing mathematical computations and procedures. The elementary mathematics curriculum was streamlined so that more time could be spent on basic understandings and skills of addition, subtraction, multiplication, division and problem - solving techniques. The secondary curriculum was broadened to include a variety of course offerings leading to a wide range of career opportunities.

This program allows for different teaching and learning styles. It also provides for each student, regardless of background, ability, or interest, to pursue a program that is appropriate for him now, and one that he can rely upon for the future.

PROGRAM GOALS

The program provides a flexible district-wide sequence of objectives to meet common goals.

The program provides for discovery and development of concepts, computational skills and procedures.

The program provides experiences based upon the student's needs which enable the student to solve problems.

The program provides more time for attaining competence in basic skills of addition, subtraction, multiplication and division.

The program provides for meaningful experiences to reinforce personalized objectives and for relating these experiences to other curriculum areas.

The program provides for an extension of mathematics into leisure areas, aesthetic areas, and career opportunities.

EXPLANATION of CHART
PROGRAM at a GLANCE

The Program at a Glance shows the seven state coordinated strands, NON-METRIC GEOMETRY, NUMBER and NUMERATION, MATHEMATICAL SENTENCES, OPERATIONS and THEIR PROPERTIES, MEASUREMENT, CHARTS and TABLES, STATISTICS and PROBABILITIES, with each strand goal K-12 channeled into and around OPERATIONS and THEIR PROPERTIES.

The continuous progression depicted in this pictorial graph is translated into level by level mastery objectives in the K-8 program and course level mastery objectives in each subject taught in grades 9-12 ---

This diagram describes the elements of the mathematics program. The strands begin at kindergarten level and spirals around and through all levels to and beyond the twelfth grade.

Simple concepts and operations are introduced at kindergarten level, becoming more complex as the student progresses to the twelfth grade.

At the end of grade eight the student will have completed the basic program, which serves as a guide to determine the course offerings that could be pursued through high school. Students failing to complete the basic program will be recycled into remedial courses. Beginning at the eighth grade level and continuing through the twelfth, the diagram shows a branching into different course offerings. The spiral is extending beyond twelfth grade to show learning continues beyond the high school level.

Computational Skills and Processes

STRANDS

NON-METRIC GEOMETRY

Compare, identify, describe geometric figures, lines, planes, and solids.

Ex.

NUMBER AND NUMERATION DEVELOPMENT

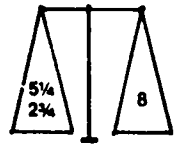
Develop the decimal numeration system.

Ex.

0, 1, ½, .25, π

MATHEMATICAL SENTENCES

Ex. 5¼ + 2¾ = 8



OPERATIONS AND THEIR PROPERTIES

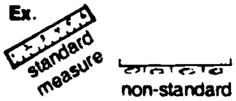
Ex.

123 + 456 > 579872 − 75679 × √4

MEASUREMENT

Measurement using various standard and non-standard measures.

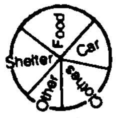
Ex.



non-standard measure

CHARTS, GRAPHS AND TABLES

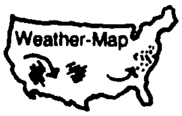
Ex.



Budget

Interpret and use charts, graphs, and tables.

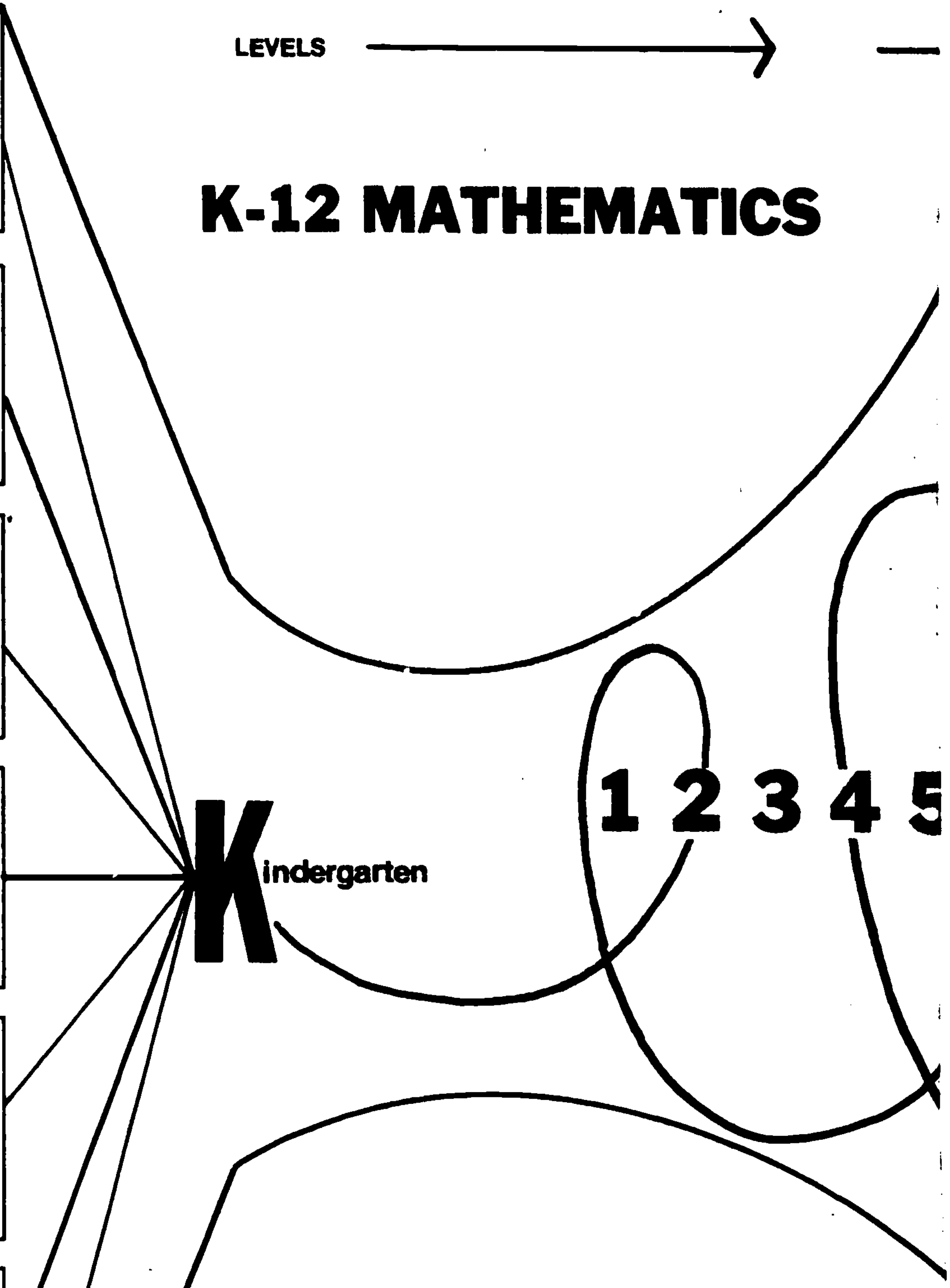
STATISTICS AND PROBABILITY



Ex.

Chance of rain on Wednesday — 50%

K-12 MATHEMATICS



EXPLANATION OF CHART
PROGRAM AT A GLANCE

The Program at a Glance shows the seven strands, *NON-METRIC GEOMETR NUMBER AND NUMERATION, MATHEMATICAL SENTENCES, OPERATIONS A THEIR PROPERTIES, MEASUREMENT, CHARTS, GRAPHS AND TABL STATISTICS AND PROBABILITIES,* with each strand channeled into and arou *OPERATIONS AND THEIR PROPERTIES.*

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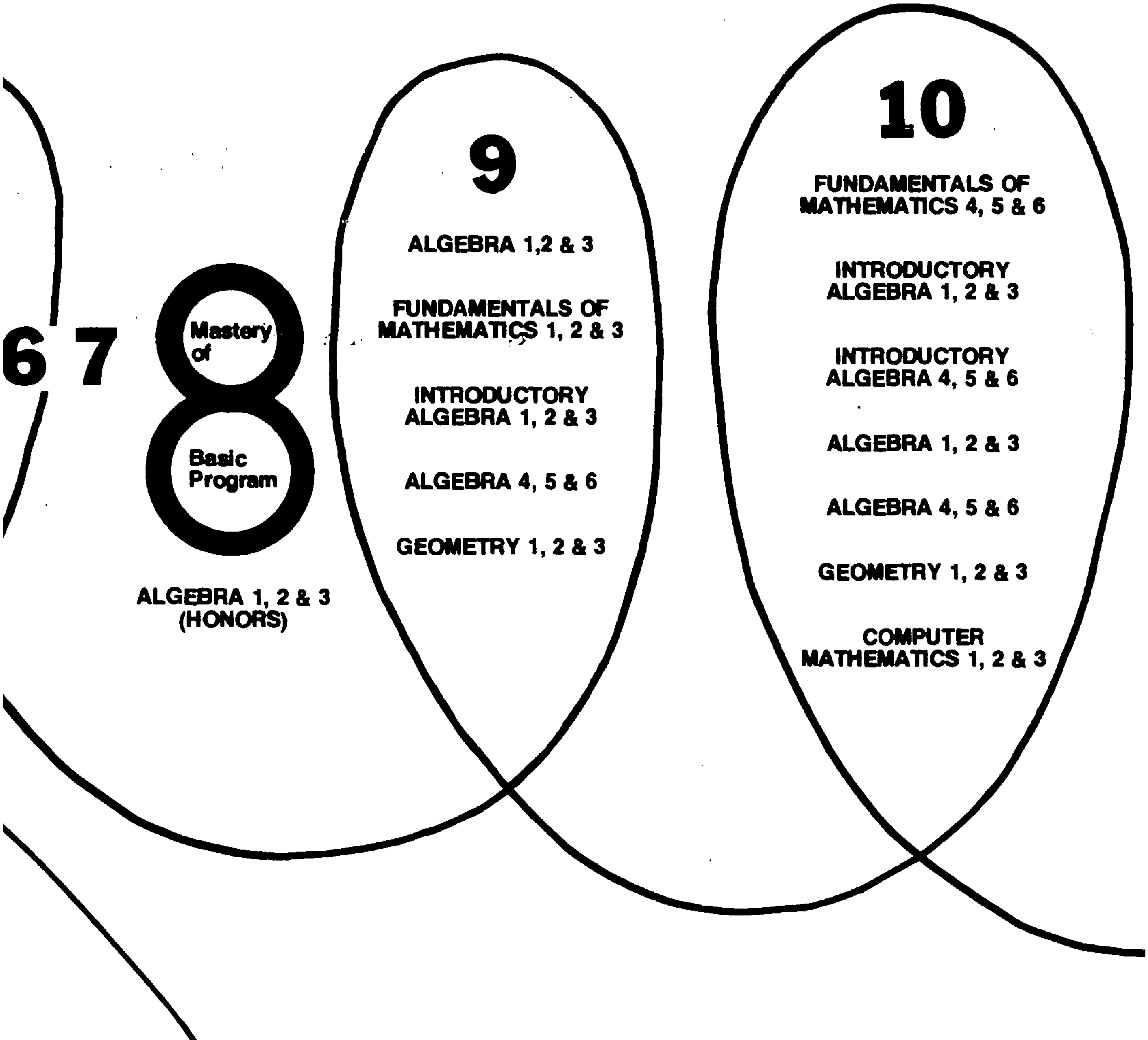
Simple concepts and operations are introduced at kindergarten level, becoming more complex as student progresses to the twelfth grade.

At grade eight the student will have completed a basic foundation which serves as a guide to determine course offerings that could be pursued through high school. (See Expected Outcomes, p.5&6 Evaluation Form for Ninth Grade Math, p.63.) Beginning at the eighth grade level and continuing thro the twelfth, the diagram shows a branching into different course offerings. The spiral is extending bey twelfth grade to show learning continues beyond the high school level.

10

PROGRAM AT



6 7

8

Mastery of

Basic Program

ALGEBRA 1, 2 & 3
(HONORS)

9

ALGEBRA 1,2 & 3

FUNDAMENTALS OF
MATHEMATICS 1, 2 & 3

INTRODUCTORY
ALGEBRA 1, 2 & 3

ALGEBRA 4, 5 & 6

GEOMETRY 1, 2 & 3

10

FUNDAMENTALS OF
MATHEMATICS 4, 5 & 6

INTRODUCTORY
ALGEBRA 1, 2 & 3

INTRODUCTORY
ALGEBRA 4, 5 & 6

ALGEBRA 1, 2 & 3

ALGEBRA 4, 5 & 6

GEOMETRY 1, 2 & 3

COMPUTER
MATHEMATICS 1, 2 & 3

A GLANCE

11

FUNDAMENTALS OF MATHEMATICS 4, 5 & 6

INTRODUCTORY ALGEBRA 1, 2 & 3

INTRODUCTORY ALGEBRA 4, 5 & 6

ALGEBRA 1, 2 & 3

ALGEBRA 4, 5 & 6

MATHEMATICS OF CONSUMER ECONOMICS 1, 2 & 3

COMPUTER MATHEMATICS 1, 2 & 3

GEOMETRY 1, 2 & 3

PROBABILITY AND STATISTICS

TRIGONOMETRY 1, 2 & 3

ELEMENTARY ANALYSIS 1, 2 & 3

12

INTRODUCTORY ALGEBRA 1, 2 & 3

INTRODUCTORY ALGEBRA 4, 5 & 6

ALGEBRA 1, 2 & 3

ALGEBRA 1, 2 & 3

ALGEBRA 4, 5 & 6

GEOMETRY 1, 2 & 3

COMPUTER MATHEMATICS 1, 2 & 3

MATHEMATICS OF CONSUMER ECONOMICS 1, 2 & 3

PROBABILITY AND STATISTICS

TRIGONOMETRY 1, 2 & 3

ELEMENTARY ANALYSIS 1 & 2

ANALYTICAL GEOMETRY 1 & 2

CALCULUS 1, 2 & 3

INDEPENDENT STUDY

12

K-12

MINIMUM MASTERY OBJECTIVES EXPECTED OF ALL HIGH SCHOOL GRADUATES

The Dallas Mathematics Program emphasizes the following minimum mastery objectives. These objectives are the basic competencies in mathematics necessary for an individual to function independently in everyday life situations. Although many students will have exceeded these minimum expectancies before grade 9, appropriate courses are provided in grades 9-12 for those students requiring additional work in basic mathematical skills.

THE STUDENT CAN:

______add, subtract, multiply and divide whole numbers and use them in practical situations.

______demonstrate the ability to interpret place value using any number less than ten million.

______estimate answers, by rounding, involving the four fundamental operations.

______add, subtract, multiply and divide fractions and decimal numbers for use in practical situations.

______interpret and solve simple equations.

______use concepts and computational skills acquired to keep personal records such as banking and saving accounts, information for insurance and income tax, records of interest paid on installments or earned on investments and similar consumer affairs.

______identify the kind of unit to use for determining the measure of a particular object.

______count various combinations of paper money and coins up to $100, and make change from $100 for any purchase under that amount.

______use tables of weights/mass to convert tons to pounds to ounces or kilogram to grams and tables of volumes to convert gallons to quarts to pints or liters to milliliters.

______use a meter stick or yard stick to measure lengths (dimensions) and given the formulas, use the measures found to compute areas of surfaces and volumes of solids or containers.

______add, subtract, multiply and divide using measures and solve simple problems involving measures.

______demonstrate knowledge of measuring devices (including metric) by explaining their uses and use a variety of measuring devices for personal, shop or leisure time needs.

K-12
MINIMUM MASTERY OBJECTIVES EXPECTED OF ALL HIGH SCHOOL GRADUATES

_____use scales to indicate locations and maps to determine distances between two geographic locations.

_____use ratios and percent in problem solving situations such as making comparisons, interpreting charts, enlarging and reducing sizes, and managing personal finances.

_____demonstrate the understanding of the concepts of the number line by using one scale or two scales (graph) to locate a position.

_____read and interpret mathematical information on a chart or graph such as circle, bar, line and picture graphs.

K-8 MASTERY OBJECTIVES

The following pages consist of level-by-level mastery objectives with examples. These mastery objectives identify those basic skills in which mastery is essential before progression at the next level can be successfully achieved. The objectives are sequenced within each level for continuous progress.

A suggested criterion-referenced measure is provided to assist the teacher in level placement and in determining the percent of mastery.

KINDERGARTEN LEVEL
MASTERY OBJECTIVES

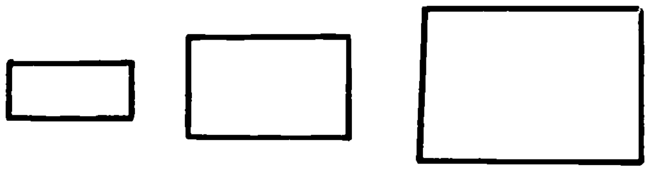
Using real objects the student will:

1. Identify a triangle, square, circle and rectangle.

   Example: Point to the circle.

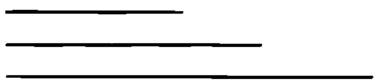
2. Compare triangles, squares, circles and rectangles by size (large, small).

   Example: Point to the large rectangle.



3. Compare three objects of different lengths (tallest, longest, shortest).

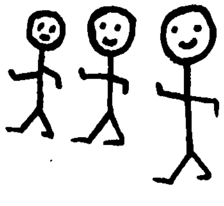
   Example: a. Which is longest?



   b. Which is tallest?

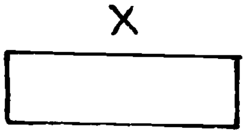
4. Compare the weight of objects in the following ways: most, least, heaviest, lightest.

   Example:
   a. Which weighs least?
   b. Which weighs the most?
   c. Which is heaviest?
   d. Which is lightest?



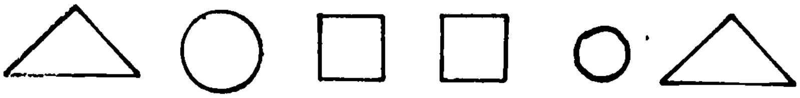
5. Use the following words correctly: next, last, near, far, above, below, over, under, top, bottom, between, inside, outside, on.

Example: Put an X above the rectangle.



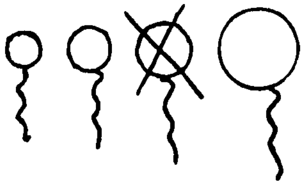
6. Match and classify triangles, squares, circles and rectangles that are alike by color, shape, size and thickness.

    Example: Put together the objects that are alike in shape.



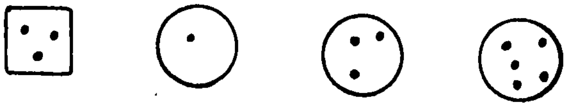
7. Identify the position of an object (first - fifth).

    Example: Put an X on the third balloon counting from left to right.



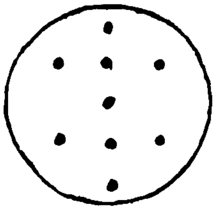
8. Identify equivalent sets by matching 1 to 1 (0 - 5).

    Example: Put an X on the set that has the same number of objects as the first set in the box.



9. Count aloud members of groups (0 - 10).

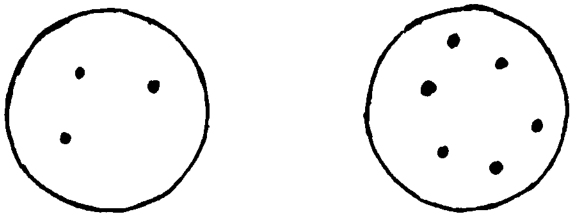
    Example: Count the objects in the group.



KINDERGARTEN LEVEL
MASTERY OBJECTIVES

10. Compare sets as being more than or less than another (0 - 10).

Example: Point to the set that has more objects.



11. Match the correct numeral (0 - 10) to groups of objects (0 - 10).

Example: Circle the numeral that represents each group.

a. 

1 2 [✓ 3]

b. 

[✓ 1] 2 3

c. 

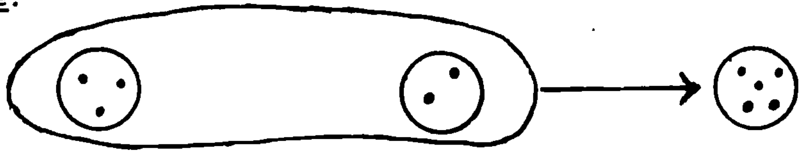
1 [✓ 2] 3

d. 

1 2 3 [✓ 4]

12. Join two groups of less than five objects and tell how many objects there are altogether.

Example:



3 + 2 = 5

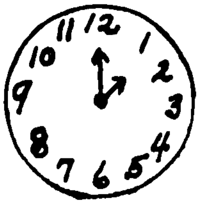
13. Separate a group of ten or fewer objects into two groups and state the number in each group.

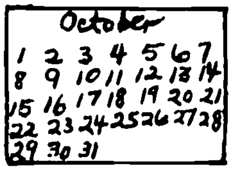
Example:

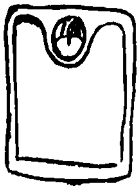
5 - 2 = 3

14. Identify a scale, calendar, thermometer and clock.

Example: Point to the clock.

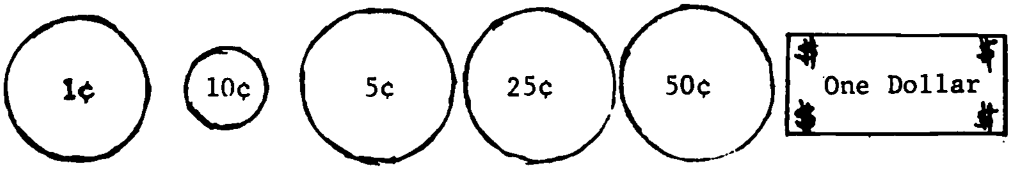






15. Identify a penny, nickel, dime, quarter, half-dollar and dollar bill.

Example: Point to the dime.

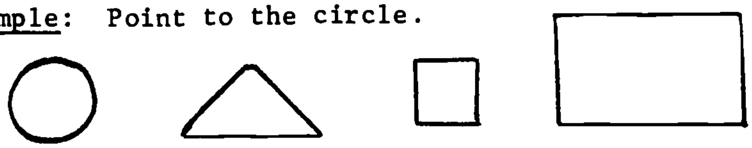


LEVEL 1
MASTERY OBJECTIVES

Using pictures and/or objects, the student will:

1. Identify and describe a circle, square, triangle and rectangle.

   Example: Point to the circle.



2. Identify 1/2, 1/3 or 1/4 when shown a circle, square, triangle and rectangle with these fractional parts shaded.

   Example:

1/2

3. Add two whole numbers less than 10 using the plus (+) sign when written horizontally or vertically.

   Example: 9 + 7 = 16

$$\begin{array}{r} 9 \\ +7 \\ \hline 16 \end{array}$$

4. Read and write any whole numeral 0 - 399.

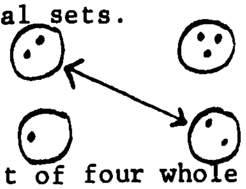
   Example: Write 145 when orally presented.

5. Identify the position of an object from left to right when a group of no more than ten objects are shown in a line.

   Example: Mark an X on the third ball.

6. Find equal sets out of a choice of four sets.

   Example: Connect the equal sets.



7. Identify the smallest or largest of four whole numbers less than 10.

   Example: Circle the smallest. 2, 5, 1, 7

8. Complete a counting sequence of numbers less than 100 by filling in the missing numerals.

   Example: Write the missing numbers. 24, ____, _____, 27

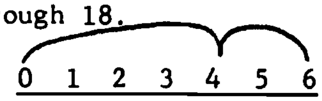
LEVEL 1
MASTERY OBJECTIVES

9. Use the symbol ($<$, $>$, $=$) to show the relationship between two whole numbers.

   Example: 7 ⧀ 9, 8 ⧁ 7, 7 ⊜ 7

10. Identify an addition fact shown on a number line and use the number line to show sums through 18.

   Example:



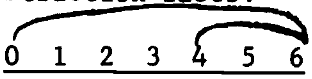
   $4 + 2 = 6$

11. Subtract whole numbers less than 10 using the minus (-) sign.

   Example: $8 - 5 = 3$

12. Identify a subtraction fact shown on a number line and use the number line to show simple subtraction facts.

   Example:



   $6 - 2 = 4$

13. Identify the cardinal number representing the number of elements remaining after a subset has been pictorially separated.

   Example:

   $10 - 5 = 5$

14. Find the sum of two numbers less than ten when one addend is zero.

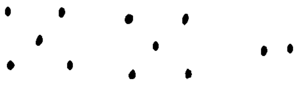
   Example: $5 + 0 = \boxed{5}$

15. Identify and write the place value of either digit when given a two-digit number.

   Example: 18 means <u>one</u> <u>ten</u> and <u>eight</u> <u>ones</u>

16. Group objects in sets of ones and tens and identify the numeral that names the set.

   Example:



   = 1 ten and 2 = 12

17. Supply the missing operation sign (plus or minus) when given incomplete equations involving simple addition and subtraction.

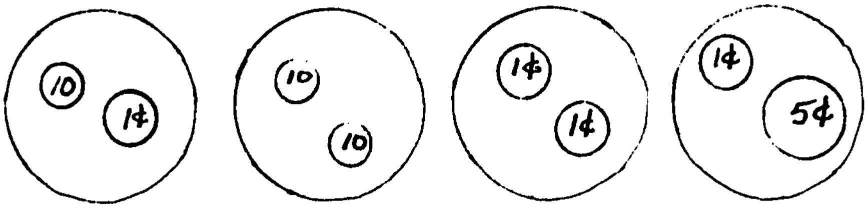
   Example: 6 ⊕ 3 = 9

   6 ⊖ 2 = 4

18. Identify the value of named coins, when given pictures of four groups of two coins.

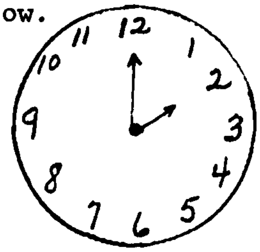
LEVEL 1
MASTERY OBJECTIVES

Example: Mark an X on the picture showing a nickel and a penny.



19. Tell time on the hour and half-hour when given pictorial representations of clocks.

Example: Make the clocks show the time indicated below.



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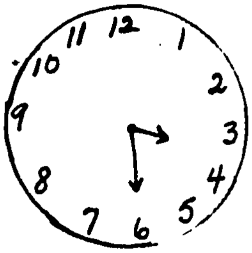

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20. Identify dates or days of the week when given a calendar.

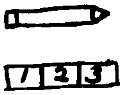
Example: Circle the date of the first Sunday of the month.

OCTOBER

S	M	T	W	T	F	S
		1	2	3	4	5
⑥	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

21. Determine the height or length of an object using non-standard units of measure.

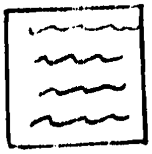
Example: How tall is the person? How long is the pencil?



22. Compare the weight of four different objects.

Example: Which thing is the heaviest?

pencil



paper

book

you

LEVEL 1
MASTERY OBJECTIVES

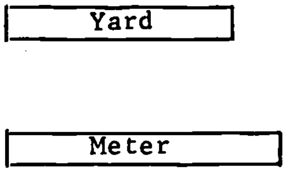
23. Find sums up to 6 in an addition table with sums missing.

Example:

+	0	1	2	3
0	0	1	2	3
1	1	2		4
2	2		4	5
3	3	4	5	

24. Compare a meter stick and a yard stick.

Example: Which is longer?

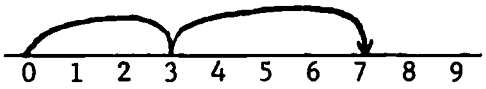


LEVEL 2
MASTERY OBJECTIVES

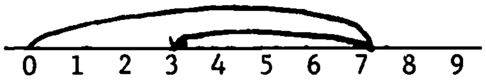
THE STUDENT WILL:

1. Use the number line to illustrate equations in addition and subtraction.

   Example: a. 3 + 4 = 7



   b. 7 - 4 = 3



2. Demonstrate an understanding of the additive property of zero.

   Example: a. 5 + 0 = ⑤

   b. 27 + 0 = ㉗

3. Demonstrate an understanding of the subtractive property of zero.

   Example: 15 - 0 = ⑮

4. Solve open sentences in addition for sums less than 20 by identifying the missing numbers.

   Example: Put the correct number in the box.

   a. 17 + $\boxed{2}$ = 19

   b. 9 + 6 = $\boxed{15}$

5. Complete an addition table up to the sum of 18.

   Example: Complete the following table.

+	0	1	2	3	4	5	6	7	8	9
0	0									9
1		2							9	
2			4					9		
3				6			9			
4	4	5	6	7	8	9	10	11	12	13
5					9	10				
6				9			12			
7			9					14		
8		9							16	
9	9									18

LEVEL 2
MASTERY OBJECTIVES

6. Complete addition and subtraction equations by supplying the proper addition or subtraction sign.

   Example: Place the proper symbol (+, -) in the circle.

   a. 5○8 = 13

   b. 8○5 = 3

7. Complete addition and subtraction statements by supplying the correct symbol (<, >, =) necessary to make a true statement.

   Example: Place the proper symbol (<, >, =) in the circle to make a true statement.

   a. 8 + 3○7 + 2

   b. 10 - 4○13 - 1

8. Compare whole numbers less than 999 using the symbols = and ≠.

   Example: Place the proper symbol (=, ≠,) in the circle to make a true statement.

   a. 50○97

   b. 117○109

   c. 75○75

9. Use a subtraction fact table to complete subtraction equations of addends less than 20.

   Example: Use this addition chart to solve related subtraction equations.

+	0	1	2	3	4	5
0	0	1	2	3	4	5
1	1	2	3	4	5	6
2	2	3	4	5	6	7
3	3	4	5	6	7	8
4	4	5	6	7	8	9
5	5	6	7	8	9	10

   a. 10 - 5 = ☐

   b. 6 + ☐ = 9

10. Order numbers up to 999 from least to greatest and greatest to least.

    Example: Order this set of numbers from least to greatest

    {57, 87, 21, 93, 17}

LEVEL 2
MASTERY OBJECTIVES

11. Identify the place value of each digit in a three-digit numeral.

Example: The place value of 4 in each of the following is:

a. $\overset{\downarrow}{4}32$ _____ b. $3\overset{\downarrow}{4}2$ _____ c. $23\overset{\downarrow}{4}$ _____

12. Write three-digit or numerals in expanded form.

Example: 127 = 100 + 20 + 7

13. Add two two-digit or three-digit numbers (with and without regrouping) showing that the order does not change the sum.

Example: a. 17 + 11 = 11 + 17 = 28

b. 67 + 32 = 32 + 67 = 99

c. 132 + 167 = 167 + 132 = 299

14. Subtract a one- or two-digit number from a two- or three-digit number (with and without regrouping).

Example:

$$\text{a.}\ \begin{array}{r} 17 \\ -\ 8 \\ \hline 9 \end{array} \qquad \text{b.}\ \begin{array}{r} 27 \\ -\ 16 \\ \hline 11 \end{array} \qquad \text{c.}\ \begin{array}{r} 258 \\ -\ 17 \\ \hline 241 \end{array}$$

15. Add amounts of money whose sums are less than $1.00.

Example: a. 25¢ + 5¢ + 3¢ = 33¢

b. 25¢ + 35¢ = 60¢

16. Classify whole numbers as even or odd.

Example: 2, 4, 6, 8, ... even

1, 3, 5, 7, ... odd

17. Identify simple geometric figures.

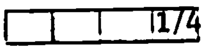
Example: a. circles 

b. triangles 

18. Name and draw fractional parts of geometric figures in terms of halves, thirds or fourths.

Example: a. 

b. 

c. 

LEVEL 2
MASTERY OBJECTIVES

19. Identify curves as closed or not closed.

Example: a.

not closed

b.

closed

20. Tell time on the hour, half-hour and quarter-hour.

21. Identify dates, weeks and months on a calendar.

22. Add two two-digit numbers (with regrouping).

Example: a. $\begin{array}{r} 73 \\ +\ 87 \\ \hline 160 \end{array}$ b. $\begin{array}{r} 29 \\ +\ 17 \\ \hline 46 \end{array}$

23. Compare English and metric units of measure.

Example: Which is longer, an inch or a centimeter?
A yardstick or a meter stick?

24. Use standard units to measure length, width or height of objects.

Example: Measure your waist in inches; measure your waist in centimeters; which measurement do you prefer?

25. Find equivalent units when given a specific unit of linear or weight measurement.

Example: a. 8 pints = ____ quarts

b. 12 quarts= ____ gallons

LEVEL 3
MASTERY OBJECTIVES

THE STUDENT WILL:

1. Identify the place value of one of the digits when given a four-digit number.

   Example: What is the place value of the 5 in each of the following?

   a. 4521 b. 5241 c. 2451 d. 1425

2. Write a four-digit number in expanded form.

   Example: 5617 = 5000 + 600 + 10 + 7

3. Identify its printed form when given the word name of a number from 0 to 10,000.

   Example: seven thousand, five hundred forty
   = 7,540

4. Add two- and three-digit numbers (without regrouping).

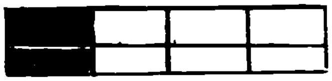
   Example: a. $\begin{array}{r} 63 \\ +\ 21 \\ \hline 84 \end{array}$ b. $\begin{array}{r} 613 \\ +\ 274 \\ \hline 887 \end{array}$

5. Add two- or three-digit numbers (with regrouping).

   Example: a. $\begin{array}{r} 74 \\ +\ 28 \\ \hline 102 \end{array}$ b. $\begin{array}{r} 826 \\ +\ 597 \\ \hline 1423 \end{array}$

6. Name the fraction which represents the shaded area when given a geometric figure divided into as many as eight parts with one or more parts shaded.

   Example:



   2/8 or 1/4

7. Name the value of money in cents, when given an illustration of no more than five coins and/or bills whose sum is less than $1.00.

   Example: 59¢ + 25¢ + 10¢ + 5¢ + 1¢ = 91¢

8. Subtract a one-digit number from a two- or three-digit number (without regrouping.)

   Example: $\begin{array}{r} 624 \\ -\ \ 3 \\ \hline 621 \end{array}$

LEVEL 3
MASTERY OBJECTIVES

9. Subtract a one- or two-digit number from a two-digit number (with regrouping).

Example:
$$\begin{array}{r} 74 \\ -\ 27 \\ \hline 47 \end{array}$$

10. Recall basic multiplication facts through 9 x 9.

Example: Complete the following table.

X	0	1	2	3	4	5	6	7	8	9
0										
1		1				5				
2										
3				9						
4										
5						25				
6					24					
7				21				49		
8			16							
9							54			

11. Multiply a three-digit number by a one-digit number (without regrouping).

Example:
$$\begin{array}{r} 321 \\ \times\ 2 \\ \hline 642 \end{array}$$

12. Use the properties of zero and one in simplifying multiplication and division problems.

Example: a. 6 x 1 = ____

b. 6 x 0 = ____

c. 7 ÷ 1 = ____

13. Divide a two-digit number by a one-digit number (no remainder).

Example: 24 ÷ 8 = ____

LEVEL 3
MASTERY OBJECTIVES

14. Solve mathematical sentences using repeated addition and/or subtraction facts (one-digit addends).

Example: a. 7 + 9 + 3 + 6 = ___ b.

$$\begin{array}{r} 8 \\ 7 \\ +\ 5 \\ \hline \end{array}$$

15. Solve open sentences in addition and/or subtraction by supplying the missing number.

Example: Put the correct number in the circle.

a. ◯ + 21 = 34

b. 65 - ◯ = 24

16. Solve an open number sentence in multiplication and/or division by supplying the correct sign of operation.

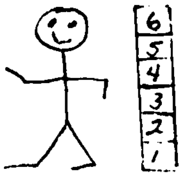
Example: Put the correct symbol (x, ÷) in the circle.

a. 24 ◯ 8 = 3

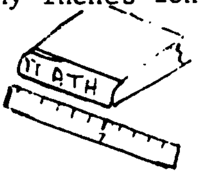
b. 3 ◯ 8 = 24

17. Use standard and/or nonstandard units to measure pictorial representations of objects.

Example: a. How many blocks tall?

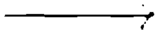


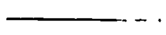
b. How many inches long is the book?

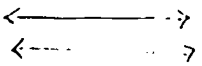


18. Identify the drawing by name when given the picture of a ray, a line segment, parallel lines or an angle.

Example: Give the name of each.

a. 

b. 

c. 

d. 

LEVEL 3
MASTERY OBJECTIVES

19. Use a calendar to answer simple questions.

Example: What is the date of the first Tuesday?

SEPTEMBER

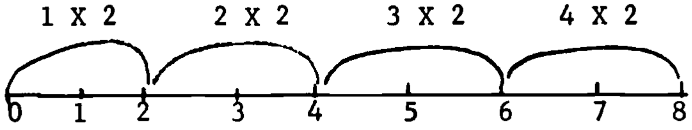
S	M	T	W	T	F	S
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30		

20. Extend and compare English and metric units of measure.

Example:
a. A mile is longer than a kilometer.
b. An inch is longer than a centimeter.
c. A meter is longer than a yard.

21. Use the number line to show multiples of 1, 2, 3 and 5.

Example: Illustrate 4 X 2 = 8 on a number line.



LEVEL 4
MASTERY OBJECTIVES

THE STUDENT WILL:

1. Add whole numbers less than 1000, written both horizontally and vertically (regrouping as necessary)

   Example: a. $\begin{array}{r} 111 \\ +\ 222 \\ \hline \end{array}$ b. $\begin{array}{r} 937 \\ +\ 284 \\ \hline \end{array}$ c. 93 + 28 =

2. Add whole numbers less than 10,000 (with regrouping).

   Example: $\begin{array}{r} 4567 \\ +\ 2984 \\ \hline \end{array}$

3. Subtract whole numbers less than 1000 (without regrouping)

   Example: $\begin{array}{r} 345 \\ -\ 214 \\ \hline \end{array}$

4. Subtract whole numbers less than 1000 (with regrouping).

   Example: $\begin{array}{r} 348 \\ -\ 289 \\ \hline \end{array}$

5. Demonstrate mastery of multiplication facts through 9 x 9.

   Example: 7 x 8 = 56

6. Multiply a two-digit number by 1 or 0.

   Example: a. 72 x 1 = ____

   b. 72 x 0 = ____

7. Multiply a two- or three-digit number by a one-digit number.

   Example: $\begin{array}{r} 634 \\ \times\ 8 \\ \hline \end{array}$

8. Complete a number sentence by supplying the missing factor.

   Example: 2 x ___ = 8

9. Divide any number less than 100 by a number less than 10 (no remainder).

   Example: 96 ÷ 3 = ____

10. Complete a division equation involving numbers less than 100 (no remainder)

LEVEL 4
MASTERY OBJECTIVES

Example: a. 32 ÷ 4 = ____

b. ____ ÷ 4 = 8

11. Divide a three-digit number by a one-digit number (no remainder).

Example: 426 ÷ 2 = ____

12. Choose the correct symbol (<, >, =) to make the sentence true.

Example: Put the correct symbol (<, >, =) in the circle.

8 + 7 ○ 12 + 2

13. Use the correct symbol (= , ≠) to make the sentence true.

Example: Put the correct symbol (= , ≠) in the circle.

27 ○ 3 x 7

14. Name the place value of any one of the digits when given a five-digit number.

Example: What is the place value of the 5?

23,578

15. Order a set of three five-digit numbers from the least to the greatest or from the greatest to least.

Example: Write the numbers in order, from least to greatest.

81,432 81,536 81,532

16. Name the missing multiples when given a series of consecutive multiples less than 100.

Example: Find the missing numbers.

4, 8, 12, 16, ____, 24, ____

17. Name the fractional number that represents the shaded portion of a figure divided into no more than eight parts the same size.

Example:

2/3

18. Add simple fractions with like denominators less than 10.

LEVEL 4
MASTERY OBJECTIVES

Example: 2/4 + 3/4 = 5/4

19. Subtract simple fractions with like denominators less than 10.

Example: 3/4 - 2/4 = 1/4

20. Name the fraction greater than 1 when given four fractions having one-digit numerators and denominators.

Example: Circle the fraction that is greater than 1.

2/3 4/4 [✓ 5/4]

21. Find the equivalent fraction when given four fractions having one-digit numerators and denominators.

Example: Circle the fraction that is equivalent to 1/2.

1/8 2/8 3/8 [✓ 4/8]

22. Find the equivalent fractions in a series of four fractions.

Example: Circle the fractions that are equivalent.

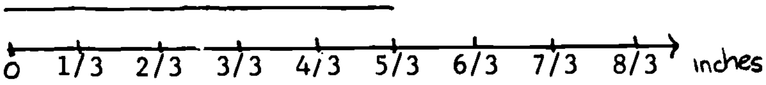
[✓ 2/4] 1/3 [✓ 1/2] 3/8

23. Determine the measure of a line segment using English and metric units, correct to the nearest 1/4 inch or centimeter.

Example: Measure the line segment using
a. English units
b. metric units

24. Find the number which names the length of the line segment when given a drawing of part of a 12-inch ruler marked off into thirds.

Example: Measure the line segment using the ruler below.



25. Find equivalent units when given a specified unit of time.

Example: a. 1 week = ____ days

b. ___weeks = 28 days

LEVEL 4
MASTERY OBJECTIVES

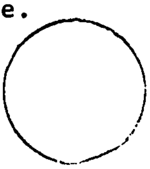
26. Find equivalent units when given a specified unit of linear or weight measurement.

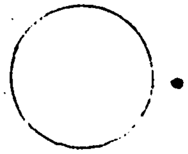
Example: a. 1 pound = ____ ounces

b. ___ inches = 2 feet

27. Find the curve that is closed, or not closed. Locate a point inside, outside or on a closed curve.

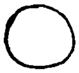
Example: Put an X on the figure showing a point outside.

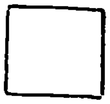
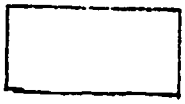





28. Identify and describe simple geometric figures (circles, triangles, rectangles, squares).

Example: Name each figure.



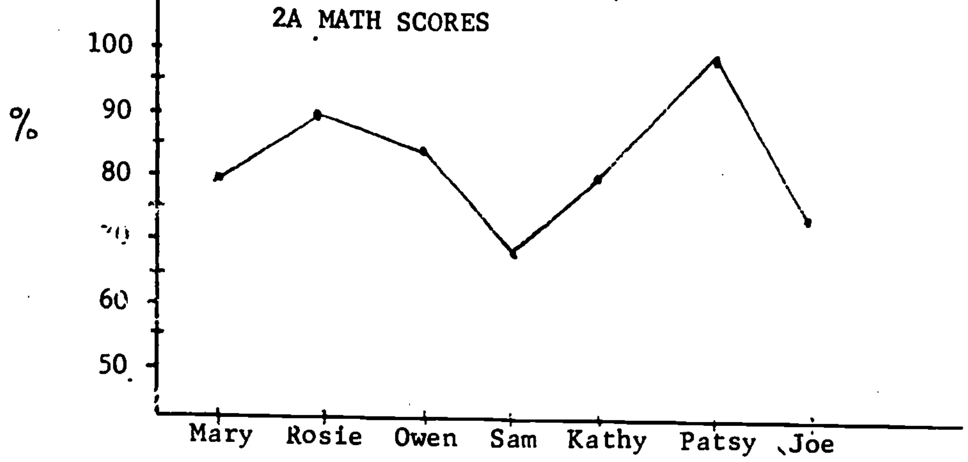
29. Read a table to answer questions when given a table conveying simple information.

Example: Which two people weigh the most?

Name	Weight
Owen	160
Kathy	105
Mary	120
Anna	121

30. Read a graph to answer questions when given a line graph conveying simple information.

Example: What score did Sam make?



LEVEL 4
MASTERY OBJECTIVES

31. Find the average of four two-digit numbers.

Example: Find the average of 67, 87, 38 and 70.

LEVEL 5
MASTERY OBJECTIVES

THE STUDENT WILL:

1. Add sets of whole numbers, each less than 10,000 (no regrouping)

   Example: a. $\begin{array}{r} 10 \\ 13 \\ 24 \\ +\ 31 \\ \hline \end{array}$ b. $\begin{array}{r} 621 \\ +\ 136 \\ \hline \end{array}$

   c. 142 + 214 + 321 =

2. Add up to four whole numbers, each less than 10,000. (with regrouping).

   Example: a. $\begin{array}{r} 11 \\ 14 \\ 25 \\ +\ 42 \\ \hline \end{array}$ b. $\begin{array}{r} 294 \\ 738 \\ +\ 927 \\ \hline \end{array}$ c. $\begin{array}{r} 4759 \\ 2746 \\ +\ 8279 \\ \hline \end{array}$

3. Subtract a three- or four-digit number from a four-digit number (without regrouping).

   Example: $\begin{array}{r} 3245 \\ -\ \ 124 \\ \hline \end{array}$

4. Subtract a three- or four-digit number from a three- or four-digit number (with regrouping).

   Example: $\begin{array}{r} 4312 \\ -\ 1324 \\ \hline \end{array}$

5. Use properties of 0 and 1 for all operations:

   Example: Solve problems of the form:
   a. 6 - 6 = ____
   b. 6 ÷ 6 = ____
   c. 6 ÷ 1 = ____
   d. 6 + _ = 6
   e. 6 x _ = 6

6. Find the product of a three-digit number and a two-digit number (with regrouping).

   Example: $\begin{array}{r} 233 \\ \times\ 14 \\ \hline \end{array}$

7. Divide a three-digit number by a two-digit number (no remainder).

   Example: $22\overline{)242}$

8. Divide a three-digit number by a one-digit number (no remainder, zero placeholder).

   Example: $5\overline{)250}$ $25\overline{)1050}$

9. Use the correct symbol (+, -, =, <, >) to make the statement true.

   Example: Put the correct symbol (+, -, =, <, >) in the circle.

   2 + 7 ○ 5 + 3

10. Complete a number sentence by supplying the missing addend or factor.

    Example: 10 + ___ = 25   50 x ☐ = 350

11. Find the place value of any digit in a six-digit number using expanded notation.

    Example: 3146 = 3 thousands + 1 hundred + 4 tens + 6 ones

12. Write the printed numeral which represents the word name of any number less than 1 million.

    Example: four hundred, twenty-six = 426

13. Round a four-digit number to the nearest ten, hundred or thousand.

    Example:
    a. 2136 = 2140, to the nearest ten
    b. 2136 = 2100, to the nearest hundred
    c. 2136 = 2000, to the nearest thousand

14. Write the set of factors of any composite number less than 61.

    Example: The set of factors of 32 is

    $\{1,2,4,8,16,32\}$

15. Write prime numbers less than 100.

16. State the numerical value of a one-digit number raised to power less than 5.

    Example: $3^3 = 3 \times 3 \times 3 = 27$

17. Complete a number sequence of six or fewer multiples of whole numbers in which each multiple is less than 1000.

    Example: Write the missing multiples.

    3, 6, 9, ___, ___, ___, ___

LEVEL 5
MASTERY OBJECTIVES

18. Write the missing numbers in a counting order, where the constant difference is no greater than 10 when given a sequence of seven or fewer whole numbers up to 1000.

Example: Find the missing numbers.

10, 20, ___, 40, ___, 60, 70

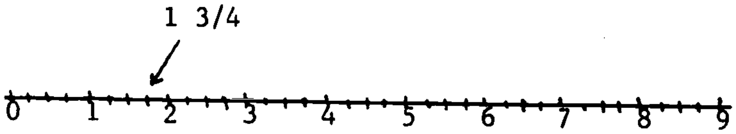
19. Name the fractional number represented by the shaded portion of a geometric figure that is divided into as many as ten fractional parts of the same size.

Example:

3/4

20. Identify the missing mixed numeral indicated by an arrow on a number line (units divided into fourths).

Example:



21. Add simple fractions with like denominators less than 20.

Example: 3/8 + 2/8 = 5/8

22. Subtract simple fractions with like denominators less than 20.

Example: 7/9 - 2/9 = 5/9

23. Find the least common denominator of two simple fractions with denominators less than 20.

Example: Find the least common denominator of 1/2 and 2/3.

24. Add simple fractions with unlike denominators less than 10.

Example: 1/2 + 1/3

25. Subtract simple fractions with unlike denominators less than 10.

Example: 3/4 - 2/3

26. Express a fraction having numerator and denominator less than 20 in simplest form.

LEVEL 5
MASTERY OBJECTIVES

Example: a. 10/15 = 2/3
b. 6/8 = 3/4
c. 3/6 = 1/2

27. Express a fraction with a denominator of 10,000 or 1000 as a decimal.

Example: Circle the decimal equal to the given fraction.

a. 5/10 : [✓ .5] .05 .005
b. 7/100 : .7 [✓ .07] .007
c. 3/1000: .3 .03 [✓ .003]

28. Add decimals to tenths (without regrouping).

Example:
$$\begin{array}{r} 2.2 \\ \underline{+\ 7.3} \end{array}$$

29. Add decimals to tenths and hundredths (with regrouping).

Example:
$$\begin{array}{r} 4.27 \\ \underline{+\ 2.18} \end{array}$$

30. Subtract decimals to tenths (without regrouping).

Example:
$$\begin{array}{r} 9.6 \\ \underline{-\ 5.3} \end{array}$$

31. Subtract decimals to tenths and hundredths (with regrouping).

Example:
$$\begin{array}{r} 5.28 \\ \underline{-\ 3.73} \end{array}$$

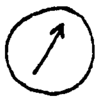
32. Add denominate numbers using English and metric measures.

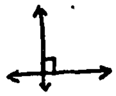
Example: a.
$$\begin{array}{r} 3 \text{ ft. } 8 \text{ in.} \\ \underline{+\ 7 \text{ ft. } 6 \text{ in.}} \\ 10 \text{ ft. } 14 \text{ in.} \\ = 11 \text{ ft. } 2 \text{ in.} \end{array}$$

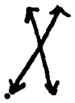
b.
$$\begin{array}{r} 76 \text{ cm} \\ \underline{+\ 24 \text{ cm}} \\ 100 \text{ cm} \\ = 1 \text{ m} \end{array}$$

33. Identify rays, parallel lines, perpendicular lines and intersecting lines.

Example: Circle the ray.

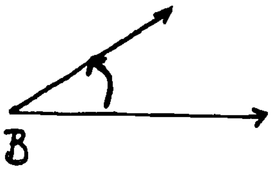






34. Use a protractor to find the measure of an angle.

Example: Find the measure of angle B.

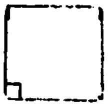
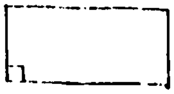


LEVEL 5
MASTERY OBJECTIVES

35. Identify and describe quadrilaterals, squares, rectangles, parallelograms, a rhombus, and trapezoids.

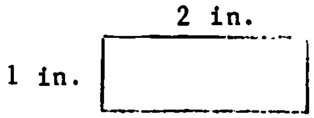
<u>Example</u>: Put an X on the square.



36. Find the perimeter of a polygon having eight or fewer sides.

<u>Example</u>: Find the perimeter of the rectangle.

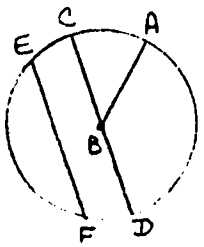


p = 1 in. + 2 in. +
1 in. + 2 in. = 6 in.

37. Identify a radius and a diameter of a circle when given a drawing of a circle with parts labeled.

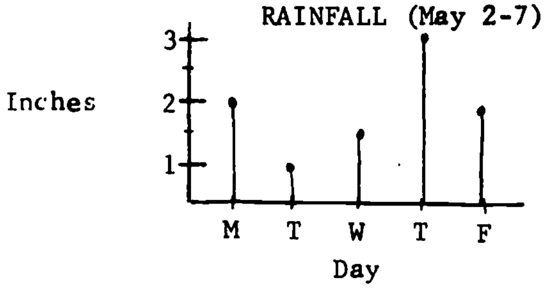
<u>Example</u>: a. Name a radius in the figure

b. Name a diameter in the figure



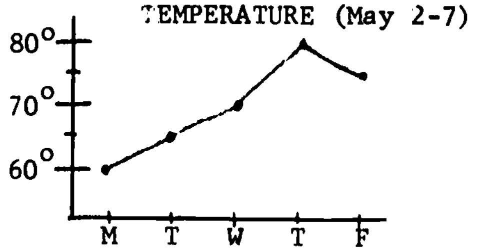
38. Answer questions relating to a table conveying simple information.

<u>Example</u>: Find the total rainfall for the 5 days.



39. Read a line graph depicting continuous data.

<u>Example</u>: Find the average high temperature for the 5-day period



LEVEL 5
MASTERY OBJECTIVES

40. Find the average (mean) of five two-digit numbers.

Example: Find the average of 10, 21, 44, 42 and 18.

LEVEL 6
MASTERY OBJECTIVES

THE STUDENT WILL:

1. Add two five- or six-digit numbers (with regrouping).

   Example:
   $$\begin{array}{r} 316{,}407 \\ \underline{+\ 127{,}665} \end{array}$$

2. Add four three-, four- or five-digit numbers (with regrouping).

   Example:
   $$\begin{array}{r} 617 \\ 116 \\ 203 \\ \underline{+\ 476} \end{array}$$

3. Subtract a three- to five-digit number from a five-digit number (with regrouping).

   Example:
   $$\begin{array}{r} 24{,}682 \\ \underline{-\ 5{,}637} \end{array}$$

4. Multiply a four- to seven-digit number by a one- or two-digit number.

   Example:
   $$\begin{array}{r} 7865 \\ \underline{\times\ 23} \end{array}$$

5. Divide a four- or five-digit number by a one- or two-digit number.

   Example: $16\overline{)3104}$

6. Complete a simple mathematical sentence with the correct symbol (+, -, =, <, >) to make a true statement.

   Example: Put the correct symbols (+, -, =, <, >) in the circles.

   16 ○ 1 = 19 ○ 2

7. Solve simple equations requiring one step and involving one- or two-digit numbers.

   Example: Solve each.

   a. $9 + \underline{\quad} = 50$
   b. $26 - 19 = \underline{\quad}$
   c. $3r = 15$
   d. $x/4 = 9$

8. State the place value of any digit in a seven-digit number using expanded notation.

   Example: 1,428,536 = 1 million + 4 hundred thousands + 2 ten thousands + 8 thousands + 5 hundreds + 3 tens + 6 ones

LEVEL 6
MASTERY OBJECTIVES

9. Round off a five-digit number to the nearest ten, hundred, thousand or ten-thousand.

<u>Example</u>: a. 36,425 = 36,430 to the nearest ten
b. 36,425 = 36,400 to the nearest hundred
c. 36,425 = 36,000 to the nearest thousand
d. 36,425 = 40,000 to the nearest ten thousand

10. Determine the prime factors of a composite number less than 60.

<u>Example</u>: 12 = 2 x 2 x 3

11. Find the value of a one-digit number raised to a power from 0 to 6.

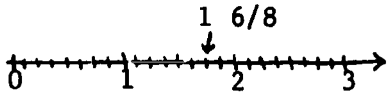
<u>Example</u>: 4^4 = 4 x 4 x 4 x 4 = 256

12. Identify the common multiple of a set of whole numbers.

<u>Example</u>: $\{6, 9, 12, 15, 18, 21\}$ are all multiples of 3.

13. Identify the point represented by a given mixed number on a number line with units divided into eighths.

<u>Example</u>:



14. Express fractions greater than one as mixed numerals.

<u>Example</u>: 13/7 = 1 6/7

15. Express mixed numerals as fractions greater than one.

<u>Example</u>: 4 1/4 = 17/4

16. Find fractions equivalent to a given fraction.

<u>Example</u>: Write 5 fractions equivalent to 1/5.

17. Order sets of fractions from Greatest to least and vice versa.

Example: Which series is in order from greatest to least?
a. 1/5, 1/4, 1/3, 1/2
b. 1/3, 1/2, 1/4, 1/5
c. 1/2, 1/3, 1/4, 1/5
d. 1/2, 1/4, 1/3, 1/5

LEVEL 6
MASTERY OBJECTIVES

18. **Add two simple fractions with unlike denominators and simplify. (denominators less than 20)**

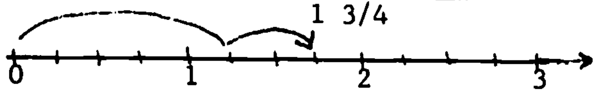
Example: 2/3 = 10/15
+ 4/5 = 12/15
22/15 = 1 7/15

19. **Add two mixed numbers with unlike denominators (denominators less than 10)**

Example: 1 1/3
+ 2 2/3

20. Recognize the point on the number line that represents the answer to an equation whose sum is less than 99.

Example: 1 1/4 + 2/4 = ____



21. **Find the difference between two simple fractions with unlike denominator (denominators less than 20).**

Example: 3/8 = 3/8
- 1/4 = 2/8
1/8

22. **Subtract two mixed numerals having unlike denominators. (denominators less than 10)**

Example: 4 2/3
- 3 1/3

23. **Multiply fractions with one digit numerators and denominators and express in simplest form.**

Example: 7/3 x 2/3 = 14/9 = 1 5/9

24. **Divide fractions (one digit numerators and denominators) and simplify.**

Example: 3/4 ÷ 1/3 = 3/4 x 3/1 = 9/4 = 2 1/4

25. Identify the place value of decimals to ten-thousandths.

Example: What is the value of the 7 **in each of the following?**

a. .007
b. .4627

26. Add decimals to thousandths (with regrouping).

Example:
$$\begin{array}{r} 4.237 \\ \underline{+5.878} \end{array}$$

27. Subtract decimals to thousandths (with regrouping).

Example:
$$\begin{array}{r} 8.327 \\ \underline{-2.438} \\ 5.889 \end{array}$$

28. Multiply decimals to hundredths.

Example:
$$\begin{array}{r} 3.24 \\ \underline{\times\ 2.1} \end{array}$$

29. **Divide decimals (tenths and hundredths) with no remainder.**

Example: $.3\overline{)\,1.8}$

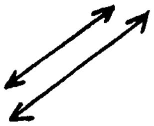
30. **Add and subtract denominate numbers using both English and metric measures.**

Example: a.
$$\begin{array}{r} 3\text{ ft. } 8\text{ in.} \\ \underline{-\ 1\text{ ft. } 9\text{ in.}} \\ 1\text{ ft.}11\text{ in.} \end{array}$$

b.
$$\begin{array}{rl} 247 & \text{grams} \\ \underline{+\ 753} & \text{grams} \\ 1{,}000 & \text{grams} \\ = 1 & \text{kilogram} \end{array}$$

31. **Draw and identify rays, parallel lines, perpendicular lines and intersecting lines.**

Example: Draw a pair of parallel lines.



32. **Find the measure of an angle given a pictorial representation of an angle and a protractor.**

Example: What is the angle measure of $\angle A$ (use your protractor)

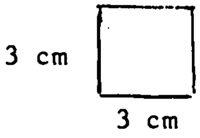
33. Identify and draw a quadrilateral, pentagon, hexagon and octagon.

Example: Draw a pentagon.

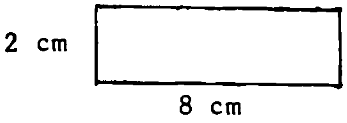
34. Find the area of a square or rectangle.

Example: Find the area of each figure.

a. square



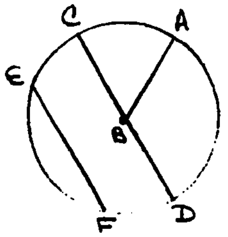
b. rectangle



LEVEL 6
MASTERY OBJECTIVES

35. **Identify a chord, a radius, a diameter or an arc when given a drawing of a circle with parts labeled.**

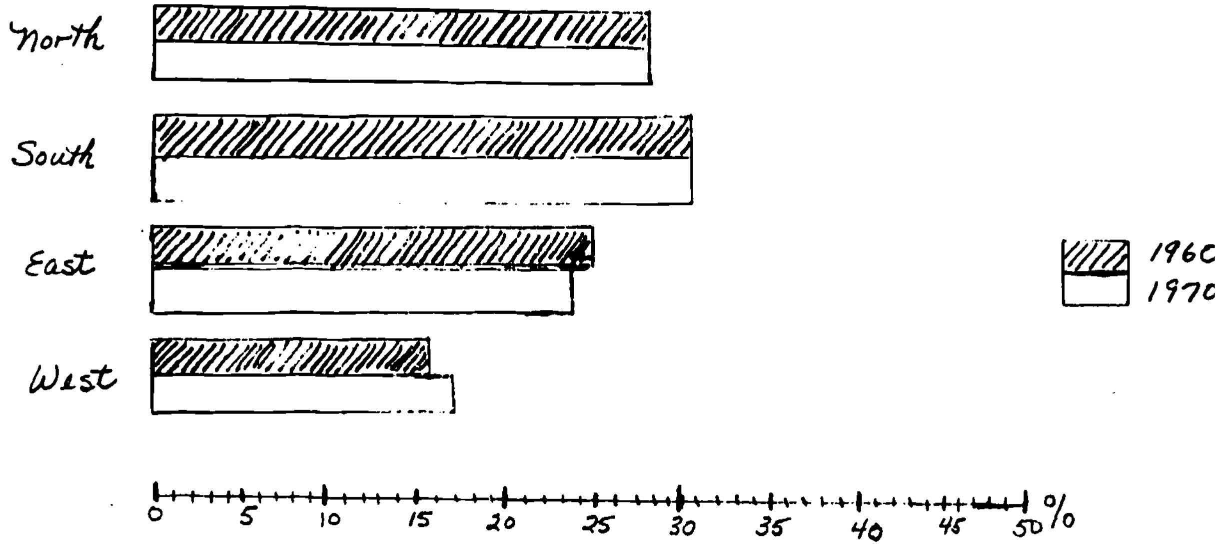
Example:



a. Name a chord.
b. Name a radius.
c. Name a diameter.
d. Name an arc.

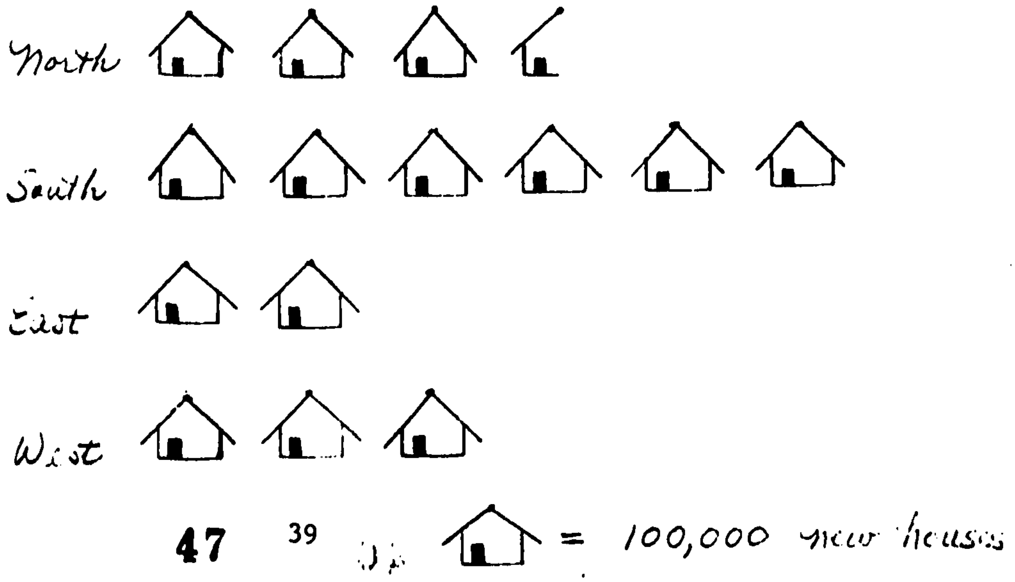
36. Answer questions pertaining to a double bar graph conveying population statistics.

<u>Example</u>: What per cent of the total population lived in the East in 1960?



37. Interpret a pictograph showing data from the world of work.

<u>Example</u>: How many new houses were built either in the North or East?



LEVEL 6
MASTERY OBJECTIVES

38. Find the average (mean) of seven whole numbers each having no more than three-digits.

    Example: Find the average of 1, 3, 3, 6, 5, 2 and 8.

39. Find the union and intersection of two given sets.

    Example: $A = \{2, 3, 4\}$
    $B = \{2, 4, 6, 8\}$

    a. Find $A \cup B$.
    b. Find $A \cap B$.

LEVEL 7
MASTERY OBJECTIVES

THE STUDENT WILL:

1. Add four whole numbers of any size, regrouping as necessary.

   Example: a. $\begin{array}{r} 73 \\ 98 \\ 52 \\ \underline{+\ 61} \end{array}$ b. $\begin{array}{r} 10{,}752 \\ 67{,}893 \\ 42{,}104 \\ \underline{+\ 31{,}819} \end{array}$

2. Subtract whole numbers, each less than 100,000, regrouping as necessary.

   Example: a. $\begin{array}{r} 1003 \\ \underline{-\ 975} \end{array}$ b. $\begin{array}{r} 97{,}372 \\ \underline{-\ 83{,}417} \end{array}$

3. Multiply any whole number by a whole number less than 1000.

   Example: a. $\begin{array}{r} 97 \\ \underline{\times\ 23} \end{array}$ b. $\begin{array}{r} 575 \\ \underline{\times\ 239} \end{array}$

4. Divide any whole number by a whole number less than 1000.

   Example: a. $27\overline{)\,9003}$ b. $372\overline{)\,75{,}920}$

5. Estimate the sum of a column of four whole numbers, each less than 1000.

   Example: $76 + 27 + 12 + 18 \doteq 80 + 30 + 10 + 20 \doteq 140$

6. Round off whole numbers.

   Example:
   a. 7558 = 7560, to the nearest ten
   b. 7558 = 7600, to the nearest hundred
   c. 7558 = 8000, to the nearest thousand
   d. 7558 = 10,000, to the nearest ten-thousand

7. Solve a simple one- or two-step equation with one unknown.

   Example: Solve each.
   a. $3x + 2 = 14$ $(x = 4)$

   b. $5x + 9 = 19$ $(x = 2)$

8. Find the greatest common factor of two whole numbers, each less than 100.

   Example: Find the GCF of 96 and 72.

   $$96 = 2 \times 2 \times (2 \times 2 \times 2 \times 3)$$

   $$\underline{72 = (2 \times 2 \times 2 \times 3) \times 3}$$
   $$\text{GCF} = 2 \times 2 \times 2 \times 3 = 24$$

9. Find the least common multiple of two whole numbers, each less than 100.

Example: Find the LCM of 96 and 72.

96 = 2 x 2 x 2 x 2 x 2 x 3

72 = 2 x 2 x 2 x 3 x 3

LCM = 2 x 2 x 2 x 2 x 2 x 3 x 3 = 288

10. Square a whole number.

Example: The square of 6; 6^2 = 6 x 6 = 36.

11. **Find the square root of a perfect square whole number**

Example: $\sqrt{25}$ = 5

12. Simplify exponential expressions.

Example: a. 2^3 = 2 x 2 x 2 = 8

b. $2^3 \times 3^2$ = 2 x 2 x 2 x 3 x 3 = 72

13. Add two or more simple fractions with like and unlike denominators and express the answer in simplest form.

Example: a 2/3 + 1/5 = 10/15 + 3/15 = 13/15

b. 3/4 + 1/4 = 4/4 = 1

c. 5/9 + 1/2 = 10/18 + 9/18 = 19/18 = 1 1/18

14. Add two or more mixed numbers with like and unlike fractional parts and express the answer in simplest form.

Example: a. 7 1/3 + 2 2/3 = 9 3/3 = 10

b. 8 2/5 + 9 1/2 = 8 4/10 + 9 5/10 = 17 9/10

15. Subtract fractions with like and unlike denominators and express the answer in simplest form.

Example: 3/4 - 2/3 = 9/12 - 8/12 = 1/12

16. Subtract mixed numbers with like and unlike fractional parts and express the answer in simplest form.

Example: a. 10 1/3 - 2 2/3 = 9 4/3 - 2 2/3 = 7 2/3

b. 7 1/8 - 6 3/4 = 6 9/8 - 6 6/8 = 3/8

17. Change a fraction greater than 1 to a mixed number, and vice versa.

Example: a. 17/8 = 2 1/8

b. 2 1/8 = 17/8

LEVEL 7
MASTERY OBJECTIVES

18. Multiply fractions and mixed numbers and express the answer in simplest form.

Example: a. 3/4 x 1/2 = 3/8

b. 7 1/2 x 1/8 = 15/2 x 1/8 = 15/16

c. 12 x 2 1/2 = 12 x 5/2 = 60/2 = 30

19. Divide fractions and mixed numbers and express the answer in simplest form.

Example: a. 3/4 ÷ 1/4 = 3

b. 2 1/2 ÷ 3/4 = 5/2 x 4/3 = 20/6 = 3 1/3

c. 4 ÷ 2/3 = 6

20. Express a ratio given in linear form as a fraction.

Example: a. 3:4 = 3/4

b. 7:10 = 7/10

21. Identify place value of decimals through millionths.

Example: What is the value of the 6x in each of the following?

a. .006
b. .00026

22. Change decimals (to hundredths) to common fractions.

Example: a. .75 = 75/100 = 3/4

b. .87 = 87/100

c. 2.5 = 2 5/10 = 2 1/2

23. Change fractions to decimals.

Example: a. 3/5 = 6/10 = .6

b. 1/2 = 5/10 = .5

c. 3/11 = $.\overline{27}$

24. Round off decimals to the nearest tenth, hundredths, thousandths and ten-thousandths.

Example: a. .572 = .57, to the nearest hundredth
b. .572 = .6, to the nearest tenth

25. Add decimals to ten-thousandths.

LEVEL 7
MASTERY OBJECTIVES

Example: a. $\begin{array}{r}3.746\\ \underline{+4.825}\end{array}$ b. $\begin{array}{r}0.172\\ \underline{+5.7}\end{array}$

26. Subtract decimals to ten-thousandths.

Example: a. $\begin{array}{r}9.321\\ \underline{-8.987}\end{array}$ b. $\begin{array}{r}10.17\\ \underline{-\ 7.825}\end{array}$

27. Multiply decimals to thousandths.

Example: a. $\begin{array}{r}4.39\\ \underline{\times\ 4.5}\end{array}$ b. $\begin{array}{r}57.72\\ \underline{\times\ \ 7.5}\end{array}$

28. Divide decimals to thousandths.

Example: a. $1.32\overline{)3.96}$

b. $17.5\overline{)100.25}$

c. $.02\overline{)5}$

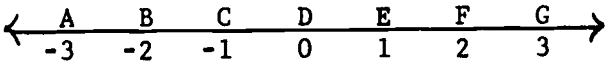
29. Change decimals to percents and vice versa.

Example: a. .75 = 75/100 = 75%

b. .5 = 50/100 = 50%

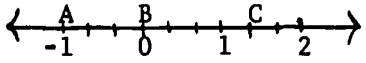
30. Order integers on a number line.

Example:



31. Identify fractional coordinates of points on a number line and vice versa.

Example: What is the coordinate of C?



32. Identify the multiplicative inverse (reciprocal) and the additive inverse of a fraction.

Example: a. The multiplicative inverse of 3/8 is 8/3, since 3/8 x 8/3 = 24/24 = 1.

b. The additive inverse of 3/8 is -3/8, since 3/8 + -3/8 = 0/8 = C.

33. Add one-digit integers (positive and/or negative).

Example: a. 4 + 2 = 6 c. 4 + -2 = 2

b. -4 + -2 = -6 d. -4 + 2 = -2

LEVEL 7
MASTERY OBJECTIVES

34. Subtract one-digit integers (positive and/or negative).

<u>Example</u>: a. $9 - 6 = 3$ c. $-9 -6 = -15$

b. $9 - (-6) = 15$ d. $-9 - (-6) = -3$

35. Add, subtract and multiply denominate numbers in the English and metric systems.

<u>Example</u>: a. 9 lb. 7 oz.
x 4
36 lb. 28 oz. = 37 lb. 12 oz.

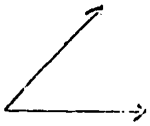
b. Express 11 dm as centimeters.

$11 \times 10 = 110$ cm

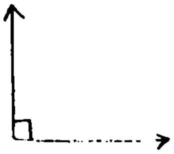
36. Classify and describe angles as acute, right, obtuse, supplementary or complementary.

<u>Example</u>: State one term that applies.

a.

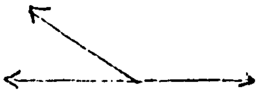


b.

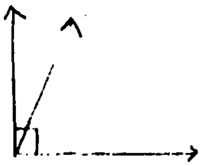


c.

d



e.

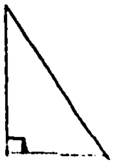


37. Classify triangles as acute, right, obtuse, equilateral, isosceles or scalene.

<u>Example</u>: State one term that applies.

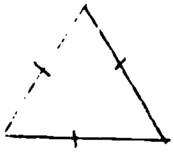
a.

b.

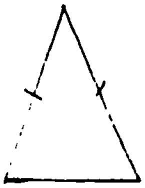


c.

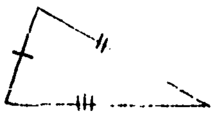
d.



e.



f.



38. Find the circumference and area of a circle when given the radius using 3.14 or 22/7 or 3 1/7 for π.

Example: a. Find the circumference of a circle with radius 3 inches. Use $\pi = 3.14$.

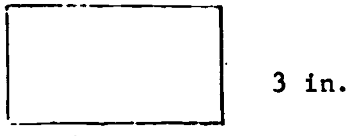
$$\begin{aligned} C &= 2\pi r \\ &= 2(3.14)3 \\ &= 18.84 \text{ inches} \end{aligned}$$

b. Find the area of a circle with radius 3 inches. Use $\pi = 22/7$.

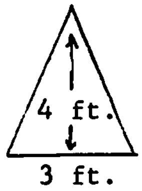
$$\begin{aligned} C &= \pi r^2 \\ &= (22/7)(3^2) \\ &= (22/7)(9) \\ &= 198/7 = 27\ 2/7 \text{ square inches} \end{aligned}$$

39. Determine the area of a geometric figure (triangle, square, rectangle, parallelogram, trapezoid) when given appropriate data.

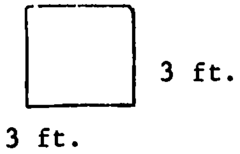
Example: a. $A = l \times w$
$= 3 \times 4$
$= 12$ sq. in.



b. $A = 1/2\ bh$
$= 1/2 \times 3 \times 4$
$= 6$ sq. ft.

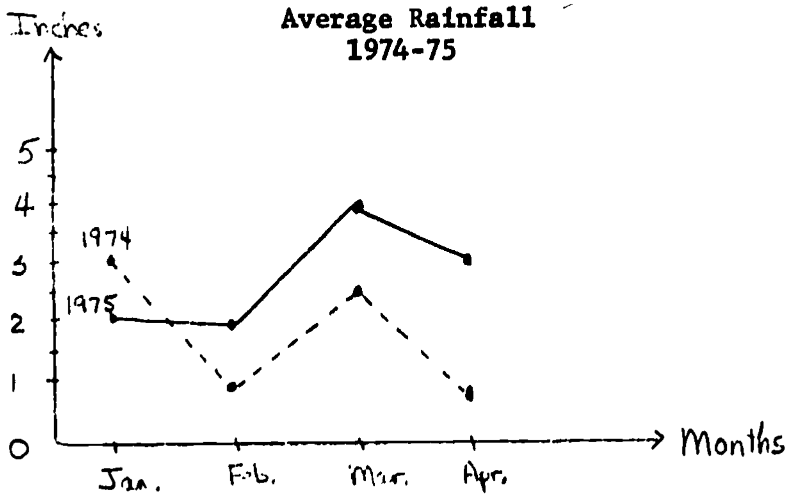


c. $A = s \times s$
$= 3 \times 3$
$= 9$ sq. ft.



40. Interpret line graphs containing two or more lines.

Example: What was the difference in the average rainfall during the month of March for the two years?



MASTERY OBJECTIVES

41. Find the mean, median, mode and range of a set of whole numbers.

<u>Example</u>: Given $\{75, 60, 15, 25, 50\}$

a. mean: $(75 + 60 + 15 + 25 + 50) \div 5 = 225 \div 5 = 45$

b. median: 75, 60, <u>50</u>, 25, 15

c. mode: There is none since each number occurs only once.

d. range: 15 to 75

LEVEL [illegible]
MASTERY OBJECTIVES

THE STUDENT WILL:

1. Add six numbers of anv size, regrouping as necessary.

   Example · 751
   7[illegible]
   [illegible]
   [illegible]15
   \+ 27
   11,670

2. Subtract any two numbers, regrouping as necessary.

   Example: 117,358
   -97,998
   19,360

3. Multiply any number by a number less than 10,000.

   Example: a. 378 x 79   b. 297 x 107

4. Divide any number by a number less than 1000.

   Example: a. 65,983 ÷ 173 = 381.40462

   b. 712 ÷ 87 = 8 16/87

   c. $12 \overline{)2567}$ = 213 r 11

5. Round off a column of whole numbers and estimate the sum.

   Example: $12 \doteq 10$

   $37 \doteq 40$
   $+45 \doteq +50$
   100 estimated sum
   94 actual sum

6. Use exponents to express numbers in expanded form.

   Example: $625 = (6 \times 100) + (2 \times 10) + (5 \times 1)$
   $= (6 \times 10^2) + (2 \times 10^1) + (5 \times 10^0)$

7. Solve simple equations and inequalities involving one variable.

   Example: a. $3x + 3 = 12$ b. $6 + 3x < 18$
   $3x = 9$ $3x < 12$
   $x = 3$ $x < 4$

8. Determine the squares and cubes of whole numbers and find the square roots of perfect squares up to 300.

   Example: a. the square of 8 is 64; $8^2 = 64$
   b. the cube of 7 is 343; $7^3 = 343$
   c. $\sqrt{225} = 15$

MASTERY OBJECTIVES

9. Find the greatest common factor (GCF) and least common multiple (LCM) of a set of whole numbers using prime factorization.

Example: Determine the LCM and GCF of set A

Set A = {24, 30, 36, 27}

24 = 2 x 2 x 2 x 3
30 - 2 x 3 x 5
36 = 2 x 2 x 3 x 3
27 = 3 x 3 x 3

GCF = 3
LCM = 2 x 2 x 2 x 3 x 3 x 3 x 5 = 1080

10. Write fractions equivalent to a given fraction or mixed number.

Example: a. 1/2 = 2/4 = 3/6 = 4/8 = ...

b. 1 2/3 = 5/3 = 10/6 = 15/9 = ...

11. Add simple fractions with unlike denominators and express the sum in simplest form.

Example: a. 1/2 + 3/7 = 7/14 + 6/14 = 13/14

b. 4/5 + 2/3 = 12/15 + 10/15 = 22/15 = 1 7/15

12. Add mixed numbers and simplify if necessary.

Example:

$$\begin{array}{rcr} 3\ 2/5 & = & 3\ 4/10 \\ \underline{+\ 1\ 1/2} & & \underline{1\ 5/10} \\ & & 4\ 9/10 \end{array}$$

13. Subtract fractions with unlike denominators and express the difference in simplest form.

Example: a. 4/5 - 2/3 = 12/15 - 10/15 = 2/15

b. 3/5 - 1/2 = 6/10 - 5/10 = 1/10

14. Subtract mixed numbers and simplify

Example:

a.
$$\begin{array}{rcr} 3\ 3/5 & = & 3\ 6/10 \\ \underline{-\ 1\ 1/2} & = & \underline{1\ 5/10} \\ & & 2\ 1/10 \end{array}$$

b.
$$\begin{array}{rcr} 3\ 3/5 & = & 2\ 8/5 \\ \underline{-\ 1\ 4/5} & & \underline{1\ 4/5} \\ & & 1\ 4/5 \end{array}$$

15. Multiply fractions and/or mixed numbers and express the product in simplest form.

Example: a. 3/5 x 1/2 = 3/10

b. 1 1/2 x 2 2/3 = 3/2 x 8/3 = 24/6 = 4

16. Divide fractions and mixed numbers and express the quotient in simplest form.

Example: a. 3/5 ÷ 1/2 = 3/5 x 2/1 = 6/5 = 1 1/5

b. 1 2/3 ÷ 1/3 = 5/3 x 3/1 = 15/3 = 5

MASTERY OBJECTIVES

17. Solve simple proportions for an unknown.

Example: 3/2 = n/4
2n = 12
n = 6

18. Add and subtract decimal numbers.

Example: a. 15.67 - 9.3 = 6.37

b. 7.89 + 5.12 + 67.30 + 517.15 = 594.46

19. Multiply and divide decimal numbers to hundred-thousandths.

Example: a. 3.442 x 2.1 = 7.2282

b. 18 - .003 = 6000

20. Write a linear ratio as a fraction, decimal, and percent.

Example: 3:4 = 3/4 = .75 = 75%

21. Solve percent problems for the percentage, base and rate.

Example: a. 25% of 60 = 15 (percentage)

b. 10 = 50% of 20 (base)

c. 5 is 20% of 25 (rate)

22. Solve interest problems for interest, principal, rate and time. (I = prt).

Example: p = $600 r = 6% t = 2 years

I = 600 x .06 x 2

I = $72

23. Name the additive inverse and multiplicative inverse (reciprocal) of a given rational number.

Example: a. The additive inverse of 3/8 is - 3/8 since 3/8 + -3/8 = 0.

b. The multiplicative inverse of 3/8 is 8/3 since 3/8 x 8/3 = 1.

24. Add and subtract integers.

Example:

a. Addition	b. Subtraction
71 + 62 = 133	71 - (-62) = 133
-71 + -62 = -133	-71 - 62 = -133
71 + -62 = 9	71 - 62 = 9
-71 + 62 = -9	-71 - (-62) = -9

MASTERY OBJECTIVES

25. Multiply and divide integers.

Example: a. Multiplication
8 x 2 = 16
-8 x 2 = -16
8 x -2 = -16
-8 x -2 = 16

b. Division
16 ÷ 2 = 8
- 16 ÷ 2 = -8
- 16 ÷ -2 = 8
16 ÷ -2 = -8

26. Add and subtract rational numbers including negative and positive fractions. (simplify answer where possible)

Example: a. -5.602 + 7.6 = 1.998

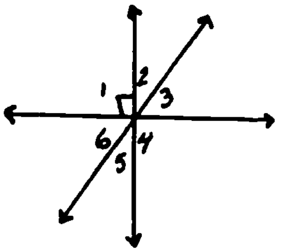
b. 4/5 - (-1/3) = 12/15 + 5/15 = 17/15 = 1 2/15

27. Multiply and divide rational numbers.

Example: a. -5.6 x 7.2 = -40.32

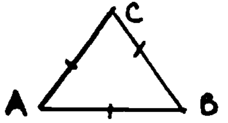
b. -2/3 ÷ =1/3 = -2/3 x -3/1 = 6/3 = 2

28. Identify and classify angles and triangles.



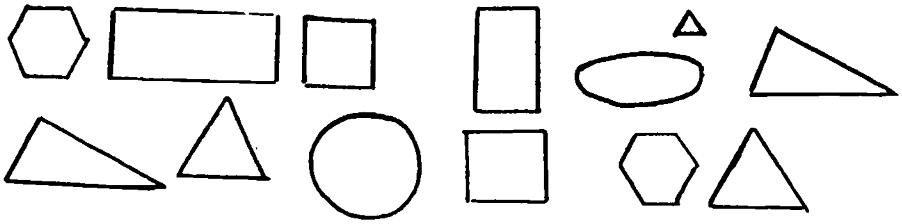
Example: a. ∠1 is a right angle.

b. △ ABC is equilaterial.



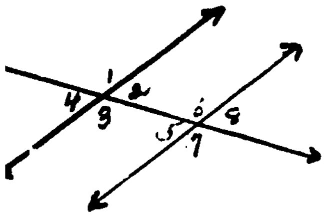
29. Identify congruent figures.

Example: Which pairs are congruent?



30. Identify the angles formed by two parallel lines cut by a transversal as corresponding, vertical, complementary, supplementary, alternate interior and/or alternate exterior angles.

Example:



a. 1 and 6 are corresponding angles.

b. 1 and 3 are vertical angles.

c. 1 and 2 are supplementary angles.

d. 2 and 5 are alternate interior angles.

e. 1 and 7 are alternate exterior angles.

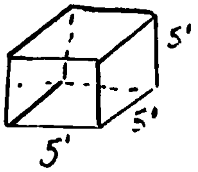
LEVEL 8
MASTERY OBJECTIVES

31. Find the perimeter, circumference, and area of geometric figures.

Example: a. Find the area of the trapezoid.
$A = 1/2\ h\ (b\ \ +b\ \ )$
$A = 1/2 \times 10\ \ (12 + 18)$
$A = 5\ (30)$
$A = 150$ sq. units

b. Find the perimeter of the trapezoid.
$P = 11 + 12 + 10 + 18$
$= 51$ units

32. Determine the volume of a cube.



Example: Find the volume.
$V = e^3$
$V = 5 \times 5' \times 5'$
$V = 125$ cu. ft.

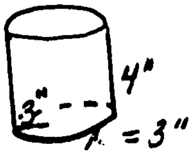
33. Add, subtract, multiply and divide denominate numbers using both English and metric units.

Example: a. 33 kilometers = 33 ÷ 1000 = .033 kilometers

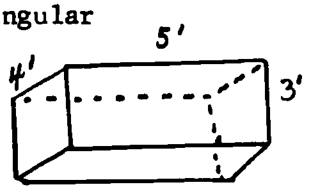
b. 7 lb. 4 oz. x 4 = 28 lb. 16 oz. = 29 lb.

34. Find the volume of a right rectangular prism, pyramid, circular cylinder and/or cone.

Example: a. Find the volume of the cylinder.
$V = \pi r^2 h$
$V = 3.14 \times 3^2 \times 4$
$V = 113.04$ cu. in.

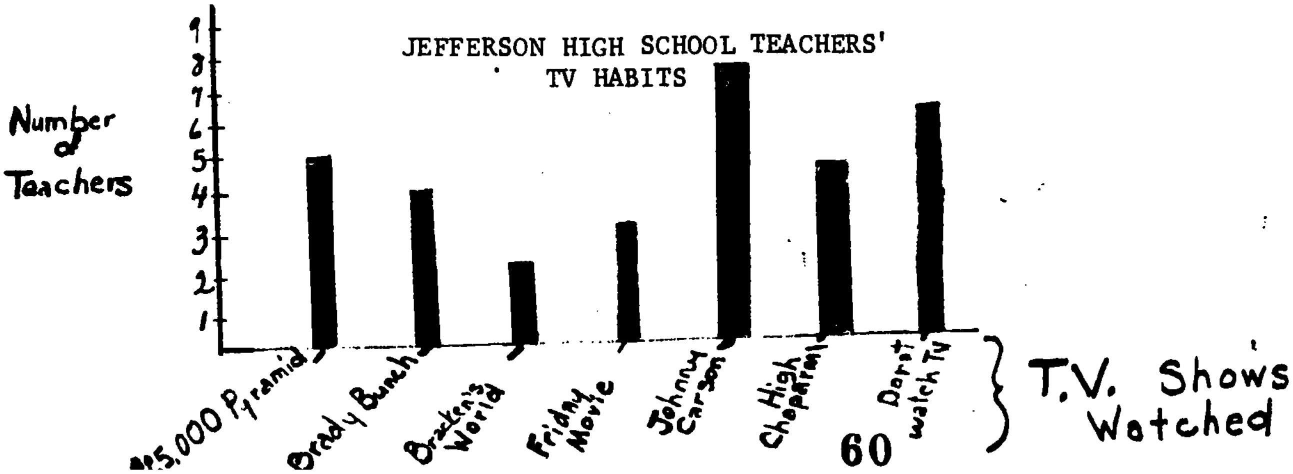


b. Find the volume of the right rectangular prism.
$V = lwh$
$V = 5 \times 4 \times 3$
$V = 60$ cu. ft.

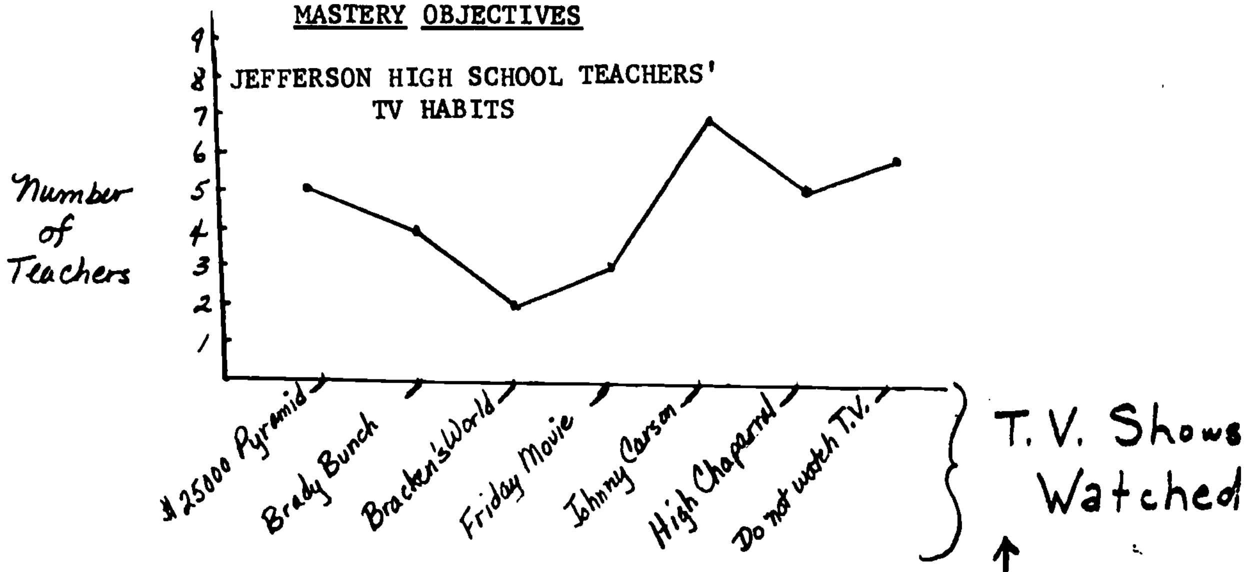


35. Interpret frequency charts, bar graphs circle graphs and line graphs.

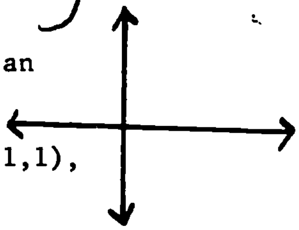
Example: a. How many teachers do not watch TV?
b. How many teachers watch the Johnny Carson Show?



LEVEL 8
MASTERY OBJECTIVES



36. Graph ordered pairs and simple sentences in the Cartesian coordinate plane.



Example: a. Graph the ordered pairs: (0,2), (1,1), (-3, 2).

b. Graph the line $y = 3x + 2$.

37. Graph simple sentences in two variables in the Cartesian coordinate plane when given the equation and a partially completed table of values.

Example: a. $x + y = 5$

x	0	5	1	2
y	5			

b. $2x + y = 6$

x	0	3	1	2
y	6			

38. Determine the probability of the occurrence of a particular event when given a simple probability sample.

Example: Find the probability of drawing a black marble from the urn. (P = 4/7)

Continuum for Teaching Mathematics

	K															1																									
OBJECTIVES	Identify basic shapes	Compare basic shapes	Compare lengths	Compare weights	Use positional terms such as near, far, in, on, etc.	Match and Classify basic shapes	Ordinal numbers (first-fifth)	Identify equivalent sets	Count aloud members of group to 10	Compare sets less than 10	Number numeral relationships (0-10)	Join groups less than five	Separate groups of 10 or less	Identify a scale, calendar, thermometer, clock	Identify money up to a dollar	Describe basic shapes	Identify fractional parts 1/2, 1/3 or 1/4	Add two 1-digit numbers	Read and write numbers to 399	Use positional terms (left, right)	Identify equal sets	Identify the smallest or largest of 4 whole numbers less than 10	Complete a series of 2-digit numbers (skip count)	Use of Symbols (<, >, =)	Addition fact on the number line for sums through 18	Subtract two 1-digit numbers	Use number line to subtract	Identify the numeral representing the number	Add zero to a number less than ten	Name and write the place value up to 2-digit	Identify the numeral that names the set	Supply operation signs in addition and subtraction	Identify the values of coins from pictures	Tell time on hour and half hour from pictures	Identify dates and days on a calendar	Use non-standard units to measure height and length	Compare weights of four different objects	Find sums up to six in a table	Compare a meter and yardstick	Do addition and
Objective no.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	1
Student's Name																																									

		umber line
		property of zero
2		Show subtractive property of zero
2	4	Solve open sentence sums less than twenty
2	5	Complete an addition table up to sums of 18
2	6	Supply the proper addition and subtraction sign
2	7	Use the correct symbol (<, >, =)
2	8	Compare whole numbers less than 999 using symbols = and ≠
2	9	Use the subtraction fact table to 20
2	10	Order and write numbers to 999
2	11	Identify place value to 3-digits
2	12	Write digit numerals in expanded form
2	13	Add 2 and 3 digit numbers with/without regrouping
2	14	Subtract 2 and 3 digit numbers with/without regrouping
2	15	Add money up to a dollar
2	16	Classify whole numbers as even or odd
2	17	Identify simple geometric figures
2	18	Identify 1/2, 1/3, 1/4 of geometric figures
2	19	Identify open and closed curves
2	20	Tell time by hour, half hour and quarter hour
2	21	Identify days, weeks and months on calendar
2	22	Add 2-digit numbers with regrouping
2	23	Compare English and metric units of measure
2	24	Measure length, width and height of objects
2	25	Make conversions using standard measures
3	1	Identify place value in a 4-digit number
3	2	Write a 4-digit number in expanded form
3	3	Identify numeral from word names up to 10,000
3	4	Add two and three numbers without regrouping
3	5	Add two and three numbers with regrouping
3	6	Name shaded area as a fraction up to 8 parts
3	7	Name the value of money in cents up to a dollar
3	8	Subtract numbers less than 1000 without regrouping
3	9	Subtract 1, 2, and 3 digit numbers with/regrouping
3	10	Recall multiplications facts up to 9 × 9
3	11	Multiply a 3-digit number by a 1-digit without regrouping
3	12	Multiplication and division involving zero and ones
3	13	Divide a 2-digit number by a 1-digit (no remainder)
3	14	Solve mathematical sentences
3	15	Supply the missing number in open sentences
3	16	Use multiplication and division sentences correctly
3	17	Use standard and non-standard measures
3	18	Identify a ray, line segment, parellel lines and angles
3	19	Use a calendar to answer simple questions
3	20	Compare English and metric measures
3	21	Use the number line to show multiples of 1, 2, 3 and 5.
3	22	
3	23	
3	24	

Continuum for Teaching Mathematics

2

OBJECTIVES	Do addition and subtraction on number line	Show additive property of zero	Show subtractive property of zero	Solve open sentence sums less than twenty	Complete an addition table up to sums of 18	Supply the proper addition and subtraction sign	Use the correct symbol (<, >, =)	Compare whole numbers less than 999 using the symbols = and ≠	Use the subtraction fact table to 20	Order numbers up to 999	Identify place value of 3-digits	Write a digit number in expanded form	Add 2 & 3 digit numbers with/without regrouping	Subtract 1, 2, & 3 digit numbers with/without regrouping	Add money up to a dollar	Classify whole numbers as even or odd	Identify simple geometric figures	Identify 1/2, 1/3, 1/4 of geometric figures	Identify open and closed curves	Tell time by hour, half hour and quarter hour	Identify days, weeks, and months on calendar	Add two 2-digit numbers (with regrouping)	Compare English and metric measures	Measure length, width and height of objects	Make conversions using standard measures	Identify place value in a 4-digit number	Write 4-digit numerals in expanded form	Identify numeral for word names up to 10,000	Add two- and three-digit numbers without regrouping	Add two & three numbers with regrouping	Name shaded area as a fraction up to 8 parts	Name the value of money in cents up to a dollar	Subtract numbers less than 1000 without regrouping	Subtract 1- and 2-digit numbers with regrouping	Recall multiplications facts up to 9 ×	Multiply a 3-digit numb	Mult
Objective no.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	1	2	3	4	5	6	7	8	9	10	11	12
Student's Name																																					

		3									4																																
digit without regrouping	and division involving zero and ones	Divide a 2-digit number by a 1-digit number	Solve mathematical sentences	Supply the missing number in open sentences	Use multiplication and division sentences correctly	Use standard and non-standard measures	Identify a ray, line segment, parallel lines and angles	Use a calendar to answer simple questions	Compare English and metric units of measure	Use the number line to show multiples of 1, 2, 3 and 5	Add numbers up to 3-digits	Add two 4-digit numbers	Subtract 2- and 3-digit numbers without regrouping	Subtract 2- and 3-digit numbers (with regrouping)	Multiply numbers 1..9 × 1..9	Multiply by one or 0	Multiply 2 or 3 digit by 1 digit	Find missing factor in multiplication problems	Divide 2-digit dividend by 1-digit divisor	Divide numbers less than 100 with no remainder	Divide 3-digit number by 1 digit	Choose (>, <, =) to make sentence true	Choose (=, ≠) to make sentence true	Name place value of digits up to 5-digits	Order a set of three 5-digit numbers	Name missing multiples given series of multiples < 100	Name fractions representing parts of figures	Add fractions with like denominators less than 10	Subtract fractions with like denominators	Identify improper fractions	Find a fraction equivalent to given fraction	Find equivalent fractions from a group of 4	Measure a segment to nearest ¼ in. or cm.	Measure segment with ruler marked into thirds	Find equivalent units, given unit of time	Find equivalent units, given linear or weight measure	Locate a point with respect to an open or closed curve	Identify circle, triangle, rectangle, square	Interpret data from a table	Read a line graph	Find average of 4 2-digit numbers		
		3	14	15	16	17	18	19	20	21	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33

Continuum for Teaching Mathematics

OBJECTIVES	3																					4																				
	Identify place value in a 4-digit number	Write a four-digit number in expanded form	Identify numeral from word names up to 10,000	Add two and three numbers without regrouping	Add two and three numbers with regrouping	Name shaded area as a fraction up to 8 parts	Name the value of money in cents up to a dollar	Subtract 1-, 2-, 3-digit numbers without regrouping	Subtract 1-, 2-, 3-digit numbers with regrouping	Recall multiplication facts up to 9 × 9	Multiply a 3-digit number by a 1-digit without regrouping	Multiplication and division involving zero and ones	Divide a 2-digit number by a one-digit (no remainder)	Solve mathematical sentences	Supply the missing number in open sentences	Use multiplication and division sentences correctly	Use standard and non-standard measures	Identify a ray, line segment, parallel lines and angles	Use a calendar to answer simple questions	Compare English and metric units of measure	Use the number line to show multiples of 1, 2, 3 and 5	Add numbers up to 3-digits	Add two 4-digit numbers	Subtract 2- and 3-digit numbers without regrouping	Subtract 3-digit numbers with regrouping	Multiply numbers 1 . . . 9 × 1 . . . 9	Multiply by one or 0	Multiply 2- or 3-digit by 1-digit	Find missing factor in multiplication problems	Divide 2-digit dividends by 1-digit divisor	Find missing divisor in equation of division	Divide 3-digit number by 1-digit	Choose correct symbol (<, >, =) to make sentence true	Choose (=, ≠) to make sentence true	Name place value of digits up to 5-digits	Order a set of three 5-digit numbers	Name missing multiples given series of multiples < 10C	Name fractions representing parts of figures	Add fractions with like denominators less than 10	Subtract fractions with like denomin	Identify improper	Fi
Objective no.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Student's Name																																										

											5																																								
o a given fraction	quivalent fractions from a group of 4	Measure a segment of nearest ¼ in. or cm.	Measure segment with ruler marked into thirds	Find equivalent units, given unit of time	Find equivalent units, given linear or weight measure	Locate a point with respect to an open or closed curve	Identify circle, triangle, rectangle, square	Interpret data from a table	Read a line graph	Find average of 4 2-digit numbers	Add numbers, up to 4-digits, without regrouping	Add numbers, up to 4-digits with regrouping	Subtract numbers, 3- or 4-digits, without regrouping	Subtract numbers, 3- or 4-digits with regrouping	Use properties of 0 and	Multiply 3-digit by 2-digit number	Divide 3-digit by 2-digit numbers (no remainder)	Divide 3- by 1-digit number (no remainder, zero placeholder)	Use (+, −, =, <, >) to make true statements	Find missing 1- or 2-digit addends or factor	Find place value in 6-digit numbers using expanded notation	Write numeral for word name of number up to 1 million	Round 4-digit number to ten, hundred, thousand	Find factors of composite number less than 61	Find prime numbers less than 100	State value of 1-digit number raised to power less than 5	Complete series of multiples < 1,000 for (2, 3, 5, 10)	Find missing numbers of series with addition constant < 10	Represent shaded part of geometric figure by fraction	Name mixed numeral graphed on number line divided into 4th's	Add simple-like proper fractions	Subtract simple-like proper fractions	Find LCD of two fractions	Add unlike proper fractions (denominators < 20)	Subtract unlike proper fractions (denominators < 10)	Write fractions (denominators < 20) in simplest form	Choose correct decimal (of 3 choices) for 10th/100th fraction	Add tenths decimals (without regrouping)	Add 10ths and/or 100th decimals (with regrouping)	Subtract 10ths decimals (without regrouping)	Subtract 10ths and/or 100th decimals (with regrouping)	Add denominate numbers (English and Metric units)	Identify rays, parallel, perpendicular, intersecting lines	Measure angle with superimposed protractor	Identify drawings of 4 different quadrilaterals	Find perimeter of n-sided polygons (n ≤ 8)	Find radius and diameter, given labeled drawing of circle	Interpret data from simple table	Read line graph of continuous data	Find mean of five 2-digit numbers	
		23	24	25	26	27	28	29	30	31	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41

Continuum for Teaching Mathematics

6

OBJECTIVES	Add two 5- or 6-digit numbers	Add four 3- to 5-digit numbers	Subtract 3- to 5-digit numbers from 5-digit numbers	Multiply 4- to 7-digit numbers by 1- or 2-digit numbers	Divide 4- or 5-digit numbers by 1- or 2-digit numbers	Complete sentences with the correct symbol (+, −, =, <, >)	Solve simple equations involving 1- or 2-digit numbers	Expand a 7-digit number	Round off 5-digit numbers	Find prime factors of numbers less than 60	Evaluate a 1-digit number raised to a power from 0-6	Identify multiples less than 1000 of a given number	Find numbers on a number line divided into eighths	Find the mixed number equivalent to an improper fraction	Reduce mixed numbers to lowest terms	Find fractions equivalent to given fractions	Find the ordered sequence of fractions	Add two unlike fractions (denominator < 20)	Add two mixed numbers (number and denominator <9)	Identify plotted solution of equation	Subtract unlike fractions, simplify	Subtract like mixed numbers (number and denominator <10)	Multiply fractions (1-digit numerator/denominator)	Divide fractions (1-digit numerator/denominator)	Identify place value of decimals to 10,000ths	Add decimals to thousandths	Subtract decimals to thousandths	Multiply decimals to hundredths	Divide decimals using tenths and hundredths	Add, and subtract denominate numbers	Identify ray, parallel, perpendicular, intersecting lines	Find measure of angle with super imposed protraction	Identify, and draw 2-, 5-, 6-, 8-sided polygons	Find area of square or rectangle	Identify, and draw chord, radiu	Interpret double b	I
Objective no.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	3
Student's Name																																					

		7																																									
Find mean of 7 whole number (≤3 digits)	Find union/intersection of two sets	Add whole numbers	Subtract whole numbers	Multiply whole numbers	Divide whole numbers	Estimate sums of whole numbers	Round off whole numbers	Solve simple equations	Find greatest common factors	Find the least common multiple	Square whole numbers	Find square roots of perfect squares	Simplify exponential expressions	Add fractions	Add mixed numbers	Subtract fractions	Subtract mixed numbers	Change fractions to mixed numbers and vice versa	Multiply fractions and mixed numbers	Divide fractions and mixed numbers	Express ratios as fractions	Identify place value of decimals	Change decimals to common fractions	Change fractions to decimals	Round off decimals	Add decimals	Subtract decimals	Multiply decimals	Divide decimals	Change decimals to per cents and vice versa	Order integers on a number line	Identify fractions on a number line	Identify multiplicative and additive inverses	Add integers	Subtract integers	Add, subtract, and multiply denominate numbers	Classify and describe angles	Classify triangles	Find the circumference and areas of circles	Find areas of geometric figures	Interpret line graphs	Find mean, media	
38	39	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	1

8

of sets of whole numbers umbers	Subtract any 2 numbers	Multiply any 2 numbers	Multiply any number by a number <10,000	Divide by a number <1000	Round off whole numbers and estimate sums	Express numbers in expanded form	Solve simple equations and inequalities	Square, cube, and find square roots	Find GCF and LCM	Find equivalent fractions	Add fractions	Add mixed numbers	Subtract fractions	Subtract mixed numbers	Multiply fractions and mixed numbers	Divide fractions and mixed numbers	Solve simple proportions	Add and subtract decimal number	Multiply, divide decimals (1000,000ths)	Write linear ratio as fraction, decimal, percent	Compute percentage, base, rate of %	Compute interest, principal, rate and time	Name inverses, (additive/multiplicative) of rational number	Add, subtract integers	Multiply/divide integers	Express simplest form of sum/diiterence of rational numbers	Express simplest form of product/quotient of rational number	Identify/classify angles and triangles	Identify congruent figures	Identify angles formed if lines are cut by transversal	Find perimeter/circumference/area	Find volume of cube	Add, subtract, multiply, divide denominate numbers	Find volume of right rectangular prism, pyramid, cylinder/cone	Interpret frequency charts, and bar, circle, line graphs	Graph ordered pairs, simple sentence in plane	Graph simple sentences in 2 variables, given equation/table	Determine probability of occurance given sample
	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	

EVALUATION FORM FOR NINTH GRADE COURSE RECOMMENDATION

Student's Name ______________________________ Grade 8

School ______________________________

Address ______________________________ Telephone ________

I. Course student desires (check one)

		Factors
	F.O.M. IQ	5
	Intro. Alg. IQ	10
	Alg. IQ	20
	Total	

II. Mastery test scores made at end of grades (high - 90-100 percentile = 50 points, average - 70-89 percentile = 40 points, low - below 70 percentile = 25 points)

	Score	Factors
7		
8		
	Total	

III. Average report card grade

(A = 50; B = 40; C = 25; D = 10)

	Grade Avg.	Factors
7		
8		
	Total	

IV. Course parents desire student take (check one)

		Factors
	F.O.M. IQ	5
	Intro. Alg. IQ	10
	Alg. I Q	20
	Total	

V. Mathematics teacher recommends student take the following course (check one)

		Factors
	F.O.M. IQ	10
	Intro. Alg. IQ	20
	Alg. IQ	30
	Total	

Total the weighted factors to determine what recommendations will be made. Use the following table to make the recommendation.

Total weighted factors: ______________________________

60 - 90 = F.O.M. IQ (Fundamentals of Mathematics)
100 - 130 - Intro. Alg. IQ (Introduction to Algebra)
150 - 170 - Algebra IQ

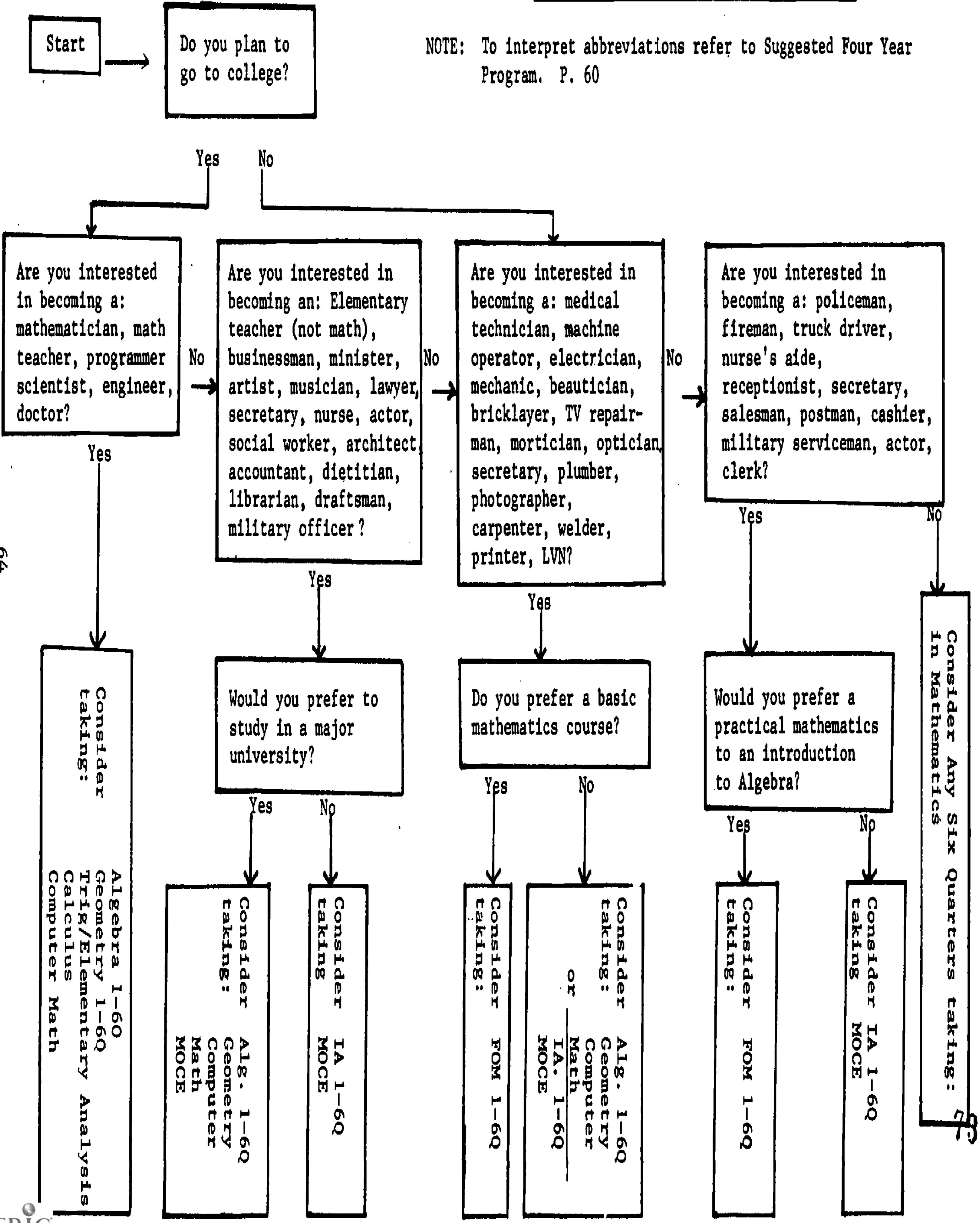
Recommendations & Comments: ______________________________

Explanation of Evaluation Form:

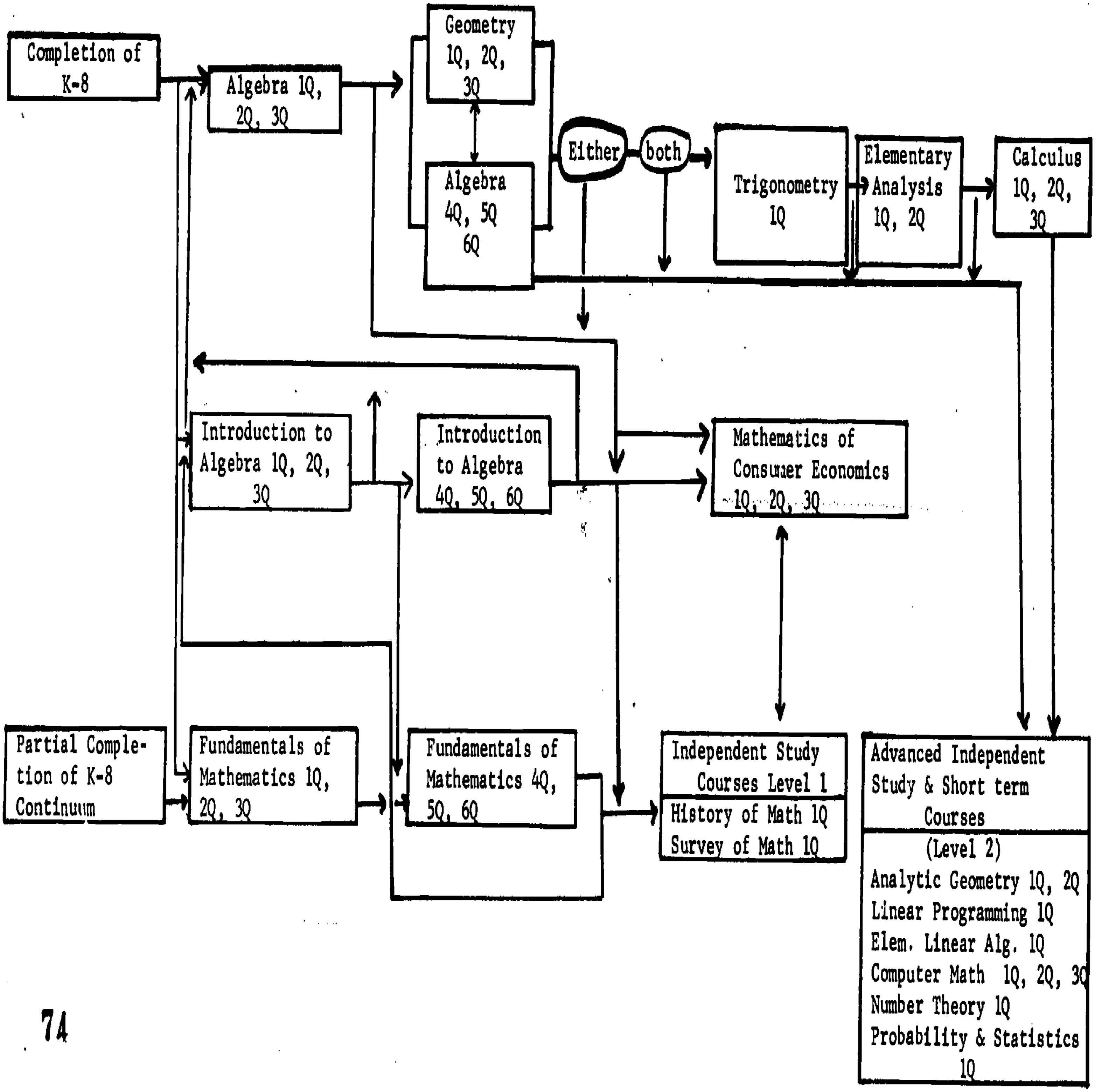
The following page contains a collection of information about a student in eighth grade. Each item has a weighted factor. The factors are to be totaled and then a course recommendation is made for the student when he enrolls in ninth grade.

CAREER PLANNING SHEET

NOTE: To interpret abbreviations refer to Suggested Four Year Program. P. 60



COURSE RELATIONSHIP GUIDE



SUGGESTED FOUR YEAR MATHEMATICS PROGRAMS
LEVEL 9-12

NOTE: CREDIT IN 6 QUARTERS OF 9-12 MATHEMATICS IS REQUIRED FOR HIGH SCHOOL GRADUATION

These recommended plans represent a representative sample of the sequences in mathematics open to individual students. For additional information regrading scheduling of mathematics students, counselors, parents, mathematics teachers, and students should refer to the Dallas Independent School Districts' General Information Bulletin 125.

Purposes and Descriptions of the various 9-12 mathematics courses preceed the mastery objectives for each course.

ABBREVIATIONS:

TRIGONOMETRY	TRIG.
INTRODUCTION TO ALGEBRA	I.A.
INDEPENDENT STUDY	IND. STUDY
ANALYTICAL GEOMETRY	A.G.
COMPUTER MATHEMATICS	COMPUTER MATH
PROBIBILITY & STATISTICS	PROB. & STAT.
FUNDAMENTAL OF MATHEMATICS	F.O.M.
ELEMENTARY ANALYSIS	E.A.
MATHEMATICS OF CONSUMER ECONOMICS	M.O.C.E.

SUGGESTED FOUR YEAR MATHEMATICS PROGRAMS
LEVELS 9-12

GRADES PROGRAMS	9	10	11	12
HONORS (MAXIMUM PROGRAM)	GEOMETRY 1-3Q →	ALGEBRA 4-6Q & COMPUTER MATH 1-3Q →	TRIG.1Q, EA.,1-2Q & PROB.&STAT. 1Q →	CALCULUS & IND. STUDY (Linear Alg. or Number Theory) Linear Programming
HONORS (REGULAR PROGRAM)	GEOMETRY 1-3Q →	ALGEBRA 4-6Q →	TRIG.1Q EA. 1-2Q & COMPUTER MATH 1-3Q →	CALCULUS 1-3Q OR ANAL. GEOM. 1-2Q & PROB.&STAT. 1Q
DOUBLE MATHEMATICS (MAXIMUM PROGRAM)	ALGEBRA 1-3Q →	ALGEBRA 4-6Q & GEOMETRY 1-3Q →	TRIG.1Q EA. 1-2Q & COMPUTER MATH 1-3Q →	CALCULUS 1-3Q OR ANAL. GEOM. 1-2Q & PROB.&STAT. 1Q

GRADES PROGRAMS	9	10	11	12
DOUBLE MATHEMATICS (REGULAR PROGRAM)	ALGEBRA 1-3Q →	GEOMETRY 1-3Q	TRIG. 1Q EA. & ALGEBRA 4-6Q →	A.G., PROB & STAT. & COMPUTER MATH
AVERAGE (MAXIMUM PROGRAM)	ALGEBRA 1-3Q →	GEOMETRY 1-3Q →	ALGEBRA 4-6Q →	TRIG. 1Q EA. 1-2Q & COMPUTER MATH 1-3Q, PROB. & STAT. 1Q, A.G. 1-2Q, I.S
AVERAGE (REGULAR PROGRAM)	ALGEBRA 1-3Q →	ALGEBRA 1-3Q →	GEOMETRY 1-3Q →	TRIG. 1Q EA. 1-2Q & COMPUTER MATH
AVERAGE (MINIMUM PROGRAM)	ALGEBRA 1-3Q →	ALGEBRA 4-6Q →	GEOMETRY 1-3Q →	M.O.C.E. & PROB. & . STAT.
BELOW AVERAGE (MAXIMUM PROGRAM)	I.A. →	ALGEBRA 1-3Q →	ALGEBRA 4-6Q →	GEOMETRY 1-3Q & COMPUTER MATH

GRADES PROGRAMS	9	10	11	12
BELOW AVERAGE (REGULAR PROGRAM)	I.A. 1-3Q →	I.A. 4-6Q →	ALGEBRA 1-3Q →	ALGEBRA 4-6Q GEOMETRY 3Q M.O.C.E. 1-3Q
BELOW AVERAGE (MINIMUM PROGRAM)	I.A. 1-30 →	F.O.M. 4-6Q →	IND. STUDY (SURVEY OF MATH) →	IND. STUDY (HISTORY OF MATH)
REMEDIAL (MAXIMUM PROGRAM)	F.O.M. 1-3Q →	ALGEBRA 1-3Q →	ALGEBRA 4-6Q →	GEOMETRY 1-3Q
REMEDIAL (AVERAGE) PROGRAM)	F.O.M. 1-3Q →	I.A. 1-3Q →	I.A. 4-6Q →	M.O.C.E. 1-3Q
REMEDIAL (MINIMUM PROGRAM)	F.O.M. 1-3Q →	F.O.M. 4-6Q →	IND. STUDY (SURVEY OF MATH) →	IND. STUDY HISTORY OF MATH)

9-12 MASTERY OBJECTIVES

The following pages consist of course-by-course mastery objectives. These Mastery Objectives identify those basic concepts and skills in each course of which mastery is essential before progression at the next level can be successfully achieved.

FUNDAMENTALS OF MATHEMATICS
1Q, 2Q, 3Q

PURPOSE:

This course is designed to provide successful and practical mathematical experiences for the high school student who needs reinforcement in the areas of computational skills and procedures.

DESCRIPTION:

This course includes:

1. a review of the fundamental skills with whole numbers, fractions and decimal numbers with emphasis placed on their uses in practical situations.
2. an investigation of percentages and integers and their utilization in problem solving.
3. a study of the ways of collecting, organizing and presenting data.
4. a study of the English and metric systems of measurement and the use of measurements in solving everyday problems.

The student should be allowed to work at his own speed but with guidance. The sequence of topics in the content overview can be adjusted to meet group or individual needs. The involvement approach with various methods and activities should be used with strong consideration given to maintaining student interest.

FUNDAMENTALS OF MATHEMATICS
1Q, 2Q, 3Q

Content Outline

FIRST QUARTER

- I. Fundamental Skills and Processes
  - A. Whole numbers
    - 1. Place value
    - 2. Fundamental operations (addition, subtraction, multiplication, division)
    - 3. Rounding and estimation
    - 4. Factors, multiples and exponents
    - 5. Squares, square roots and cubes
  - B. Integers
    - 1. Basic concepts
    - 2. Ordering
    - 3. Fundamental operations

SECOND QUARTER

  - C. Fractions
    - 1. Equivalent fractions
    - 2. Multiplication
      - a. Simple fractions
      - b. Mixed fractions
      - c. Simplifying improper fractions
    - 3. Division
      - a. Simple fractions
      - b. Mixed fractions
      - c. Simplifying improper fractions
    - 4. Addition
      - a. Like denominators
      - b. Least common factor
      - c. Unlike denominators
    - 5. Subtraction
      - a. Like denominators
      - b. Unlike denominators
  - D. Decimals
    - 1. Place value and exponential form
    - 2. Reading and writing
    - 3. Addition
    - 4. Subtraction
    - 5. Multiplication
    - 6. Division
    - 7. Changing decimals to simple fractions

- II. Ratios, Proportions, Percents, Measurements
  - A. Ratio
    - 1. Meaning
    - 2. Simplifying ratios
  - B. Proportion
    - 1. Definition
    - 2. Solving proportions

- C. Percent
    - 1. Meaning
    - 2. Percents as decimals and fractions
    - 3. Using percent in practical situations
    - 4. Estimation
    - 5. Comparisons

THIRD QUARTER

- III. Geometry and Measurements
    - A. Linear measure
        - 1. English
        - 2. Metric
    - B. Area
    - C. Volume
    - D. Angle measure
    - E. Applications
- IV. Probability and Statistics
    - A. Graphs and Tables
        - 1. Reading
        - 2. Interpretation
        - 3. Construction
    - B. Predicting the occurrence of events
    - C. Determining the mean, median, mode and range of a set of data
- V. Everyday Mathematics
    - A. Personal finance
    - B. Insurance
    - C. Taxes

FUNDAMENTALS OF MATHEMATICS
1Q, 2Q, 3Q
MASTERY OBJECTIVES

FIRST QUARTER - OBJECTIVES 1-14

THE STUDENT WILL:

1. Identify place value of a digit in a number up to 1,000,000.

   Example: Identify place value of a digit as represented by the arrow. $32\overset{\downarrow}{7}54$

2. Order a set of whole numbers each less than 10,000 in ascending and descending order.

   Example: Order the following set of numbers in ascending order. 75, 87, 54, 17, 4

3. Use the addition facts through 10 + 10 in addition and subtraction processes.

   Example: a. 5 + 7 = ____

   b. 5 + ____ = 12

4. Add four whole numbers of any size, regrouping as necessary.

   Example: $\begin{array}{r} 524 \\ \underline{+\ 175} \end{array}$

5. Subtract any two whole numbers each less than 100,000, regrouping as necessary.

   Example: $\begin{array}{r} 32,472 \\ \underline{-\ 3,975} \end{array}$

6. Demonstrate mastery of multiplication facts through 9 x 9.

7. Multiply a pair of whole numbers, each less than 10,000.

   Example: a. $\begin{array}{r} 73 \\ \underline{\times\ 8} \end{array}$ b. $\begin{array}{r} 579 \\ \underline{\times\ 23} \end{array}$

8. Divide whole numbers by numbers less than 1000.

   Example: a. $7\overline{)169}$ b. $24\overline{)575}$

9. Estimate the answers to problems involving the four fundamental operations by rounding.

   Example: Round each number to the nearest hundred and estimate the sum.

   184 + 193 + 236 + 517 ≐ 200 + 200 + 200 + 500 = 1100

10. Solve a simple problem involving the processes of addition, subtraction, multiplication and division.

Example: The price of four dozen eggs at 75¢ a dozen is __________.

11. Factor a number into a product of primes and express in exponential form.

Example: The prime factors of 64 are 2 x 2 x 2 x 2 x 2 x 2 = 2^6

12. Determine the squares and cubes of numbers.

Example: a. $25^2 = 25 \times 25 = 625$

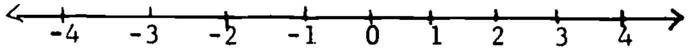
b. $3^3 = 3 \times 3 \times 3 = 27$

13. Determine the square roots of perfect squares without use of tables.

Example: $\sqrt{169} = 13$

14. Order integers using a number line and solve problems involving the four fundamental operations.

Example: a.



Which is greater, -3 or 0?
Arrange the numbers on the number line in order from largest to smallest.

b. Arrange these numbers in order from least to greatest without the use of the number line.

-23, 0, 15, 19, -45, -19, 2, 9, 12

c. (-7) + 2 =

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

e. 3 x (-5) =

f. (-3) - (-6) =

SECOND QUARTER - OBJECTIVES 15-24

15. Determine equivalent forms of fractions.

Example: a. 1/2 = 2/4 = 3/6 = 4/8 = ...

b. 1 2/3 = 5/3 = 10/6 = ...

16. Multiply simple fractions and mixed numbers.

Example: a. 3/5 x 1/2 = 3/10

b. 1 1/5 x 2/3 = 6/5 x 2/3 = 12/15 = 4/5

17. Divide simple fractions and mixed numbers and simplify.

Example: a. 3/5 ÷ 1/5 = 3/5 x 5/1 = 15/5 = 3

b. 1 2/3 ÷ 2/3 = 5/3 x 3/2 = 15/6 = 2 3/6 = 2 1/2

18. Add fractions with like denominators.

Example: 2/5 + 4/5 = 6/5 = 1 1/5

19. Add fractions with unlike denominators.

Example: 2/3 + 1/2 = 4/6 + 3/6 = 7/6 = 1 1/6

20. Subtract fractions with like denominators.

Example: 8/12 - 5/12 = 3/12 = 1/4

21. Subtract fractions with unlike denominators.

Example: 1 2/3 - 5/6 = 14/6 - 5/6 = 10/6 -5/6 = 5/6

22. Read, write and interpret decimals.

Example: a. 235.31 = $(2x10^2) + (2x10^2) + (3x10) + (5x1) + (3x1/10) + (1x1/1)$

b. Read the following aloud: 2.35798

c. Write the number that represents twenty-three and two hundred and thirty-eight thousandths.

23. Add, subtract, multiplv, and divide decimals.

Example: a. 51.4 + 7.5 = _____

b. 17.23 - 5.06 = _____

c. 3.4 x .27 = _____

d. 3.2 ÷ .25 = _____

24. Recognize that a percent is a ratio with a denominator 100 and be able to use percent in practical life situations.

Example: a. 50% = 50/100

b. 75 = 75/100 = 75%

c. 30% 30/100 = 3/10

d. 1/4 = 25/100 = 25%

e. 19 is what percent of 38?

f. 16 is 80% of what number?

g. The original price of a dress was $20.00, but is now on sale for 10% off. What is the discount? What is the sale price?

25. Use tables of weight/mass to convert tons to pounds to ounces or kilograms to grams and use tables of volume to convert gallons to quarts to pints or liters to milliliters.

Example: Use a table to determine the numbers of tons equivalent to 10,000 pounds.

26. Add, subtract, multiply and divide using measures and solve simple problems involving measures.

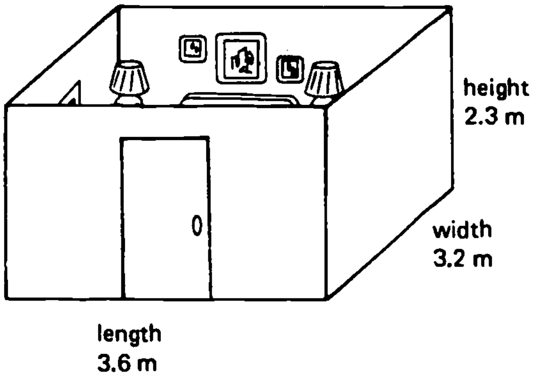
Example:

$$\begin{array}{rr} 2 \text{ lb.} & 7 \text{ oz.} \\ + 5 \text{ lb.} & 3 \text{ oz.} \\ \hline \end{array}$$

27. Measure the length, area, volume and angle of various types of objects in the classroom, home and school ground using the metric system and the English system.

Example: Answer these questions about the bedroom in the picture.

a. How many square meters of ceiling?
b. How many square meters of walls?
c. If the windows and doors cover 5 square meters, what is the total area to be painted?
d. How much paint will be needed?
e. How much will the paint cost?



One liter of paint covers 10 sq m.

28. Read and interpret mathematical information on a chart or graphs such as circle, bar, line and picture graphs.

Example: Beth Wells had her appendix removed.

City Hospital Statement	
Item	Cost
7 days @ $45	$315
Operating room	$75
Surgeon	$275
Telephone and TV	$31

How much did her father have to pay?

29. Find the probability that an event will occur and to write it as a ratio in simplest form.

<u>Example</u>: a. A math class of 29 students has 15 girls and 14 boys. Find the ratio of the number of girls to boys.

b. 15/25 = 3/5

c. Toss a penny 50 times. Record the number of times it comes up heads and the number of times it comes up tails.

d. What number is missing in the proportion?

oranges	10	5
cost	60¢	?

30. Count various combinations of money up to $100 and make change from $100 for a purchase under that amount.

<u>Example</u>: If you gave a $100 check to a clerk for purchases totaling $57.32, how much would you receive in change?

31. Fill out banking forms such as deposit slips, checks and check book records.

<u>Example</u>: Fill out the deposit slip.

FUNDAMENTALS OF MATHEMATICS
1Q, 2Q, 3Q
MASTERY OBJECTIVES

ACCT. No. ______________________

Deposited In
THE SAVINGS BANK

DATE ____________________, 19 ______
For Credit Account Of

NAME ______________________

Please advise any change of address.

	Dollars	Cents
Bills		
Coin		
Checks		
Please List Each Check		
Checks are Credited Subject to Collection		
TOTAL		

32. Determine the take home pay and specific deductions such as income tax and social security.

Example: Check to see if Ms. Sorells paycheck is correct.

Safety Bank
COMPANY
No. 42561

Date Apr. 17, 1976

Pay to the order of Rosie Sorells

One hundred two and 82/100th dollars

Owen Siddle
President

Record of Wages and Deductions
Name: DOROTHY LYNCH
Hours worked: 40 Rate: $4.93 hr.

Gross Pay	$197.20
Retirement	9.87
Federal Tax	36.40
F.I.C.A.	11.54
State Tax	6.57
Credit Union	30.00
Total Deductions	94.38
Net Pay	$102.82

FUNDAMENTALS OF MATHEMATICS
4Q, 5Q, 6Q

Content Outline

FOURTH QUARTER

I. Fundamental Processes
  A. Whole numbers
  B. Fractions
  C. Decimals
  D. Percentages
  E. Interpreting and reading charts, graphs and tables for use in daily life
  F. Practical applications and problem solving

II. Geometry and Measurement

FIFTH QUARTER

III. Consumer Awareness
  A. Banking services
    1. Interest on loans
    2. Borrowing money - promissory notes
    3. Checking accounts
  B. Saving and investments
    1. Savings accounts
      a. Compound interest
      b. Simple interest
    2. Banking investments
    3. Stocks and bonds
  C. Purchasing goods and services
    1. Food and clothing
    2. Installment purchases
    3. Comparative shopping
  D. Taxes
    1. Retail sales tax
    2. Social security and withholding taxes
    3. Income taxes
    4. Real estate taxes

SIXTH QUARTER

IV. Consumer Decisions
  A. Insurance
    1. Automobile insurance
      a. Collision
      b. Liability
      c. Comprehensive
    2. Fire insurance
    3. Home owners insurance and coverage
    4. Life insurance
  B. Transportation costs
    1. Automobile
    2. Other types
  C. Special problems

FUNDAMENTALS OF MATHEMATICS
4Q, 5Q, 6Q

PURPOSE:

This course is designed to relate mathematics to daily living and to present topics that are useful in becoming a wise consumer.

DESCRIPTION:

This course includes a study of the following:

1. A review and extension of the fundamental operations with whole numbers, fractions and decimals.
2. An exploration of the mathematics - related to the cost of food and clothing, banking services, taxation, budgeting, comparative shopping, best buys and installment purchases.
3. A study of the mathematics instruction related to consumer decisions in the area of insurance, cost of operating a car, cost of various types of transportation, cost of home ownership and renting and the cost of various leisure activities.
4. A review and extension of the different ways of representing, displaying and using data on maps, tables, graphs, household meters and charts.
5. A study of the common measurements used in everyday situations.

For many students this will be the final mathematics course, so it must be able to serve as a foundation for future vocational or technical study.

Differences in classes and individuals necessitate a flexible approach to the content of the course. The course should be activity-oriented and should involve as much student participation as possible.

    1. Wages
    2. Budgeting
    3. Depreciation
D. Home ownership and renting
E. Leisure activities

FUNDAMENTALS OF MATHEMATICS
4Q, 5Q, 6Q
MASTERY OBJECTIVES

FOURTH QUARTER - OBJECTIVES 1-13

THE STUDENT WILL:

1. Arrange a set of whole numbers in order from least to greatest or from greatest to least.

   Example: Using the digits 5, 1, 4, 9 and 2, write the following numbers:

   a. The smallest number possible
   b. The largest number possible
   c. The number closest to 32810
   d. The largest even number possible
   e. The largest odd number possible

2. Use the operations of addition, subtraction, multiplication, division and rounding off to answer questions about practical problems and/or in game situations which use whole numbers.

   Example: Find the total number of square miles included in the Texas five-state area.

State	Number of Square Miles
Arkansas	52,175
Louisiana	45,155
New Mexico	121,445
Oklahoma	68,984
Texas	262,970

3. Arrange a set of integers in order from least to greatest or from greatest to least.

   Example: Arrange the following elevations above sea level in order from lowest to highest.

Peak-Location	Feet Above Sea Level
Mt. Everest - Asia	29,028
Mt. Kennedy - Alaska	16,286
Mt. McKinley - Alaska	20,320
Pikes Peak - Colorado	14,110
Mt. Rainier - Washington	14,410

4. Use the operations of addition, subtraction, multiplication and division to answer specific questions about practical problems and/or in game situations which use integers.

   Example: Set up a "running" bank balance using the following information. What is the balance after the final transaction?

   a. Deposit $100
   b. Write a check for $56

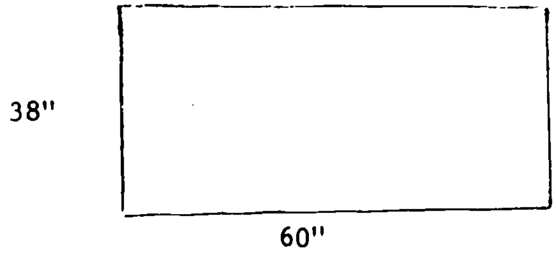
c. Write a check for $38
d. Deposit $52
e. Write a check for $62
f. Deposit $40

5. Arrange in order a set of rational numbers in fractional form from least to greatest or from greatest to least.

Example: Arrange the following fractions in order from least to greatest: 1/2, 2/3, 5/8, 5/6, 1/6.

6. Use the operations of addition, subtraction, multiplication, division and rounding off to answer specific questions in practical problems and/or in game situations which use rational numbers.

Example: Draperies are to be made for windows in your classroom. The material is 45" wide. The bottom hem is to be 2 1/2", the top hem is to be 3 1/2" and each side side hem will require 1 1/2" of fabric. What length of the material is needed for the window if the 45" width runs from top to bottom?



7. Arrange in order a set of nonintegral rational numbers in decimal form from least to greatest or from greatest to least.

Example: Arrange the average hourly earnings in order from highest to lowest.

Occupation	Average Hourly Earnings
Barber	$5.63
Beautician	5.05
Janitor	1.88
Nurses Aid	3.13
Plumber	8.75
Teacher	6.88

8. Use the operations of addition, subtraction, multiplication, division and rounding off to answer specific questions in practical problems and/or game situations containing decimals.

Example: Use the grocery list below and find the prices of the items by consulting the newspaper advertisements for each store listed. Find and compare the total costs for the items at each store.

FUNDAMENTALS OF MATHEMATICS
4Q, 5Q, 6Q
MASTERY OBJECTIVES

Grocery List

1 lb. Folger's Coffee
2 - 4oz. cans of Chicken of the Sea tuna
1 - 16oz. package of Minute Rice
5 dozen eggs

Total Cost

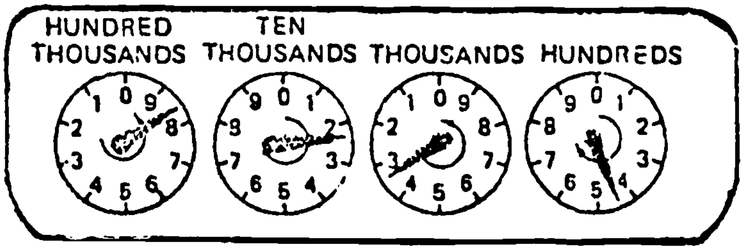
Safeway ________
7 - 11 ________
Kroger ________

9. Perform calculations involving percent.

Example: 75% of 300 is ________

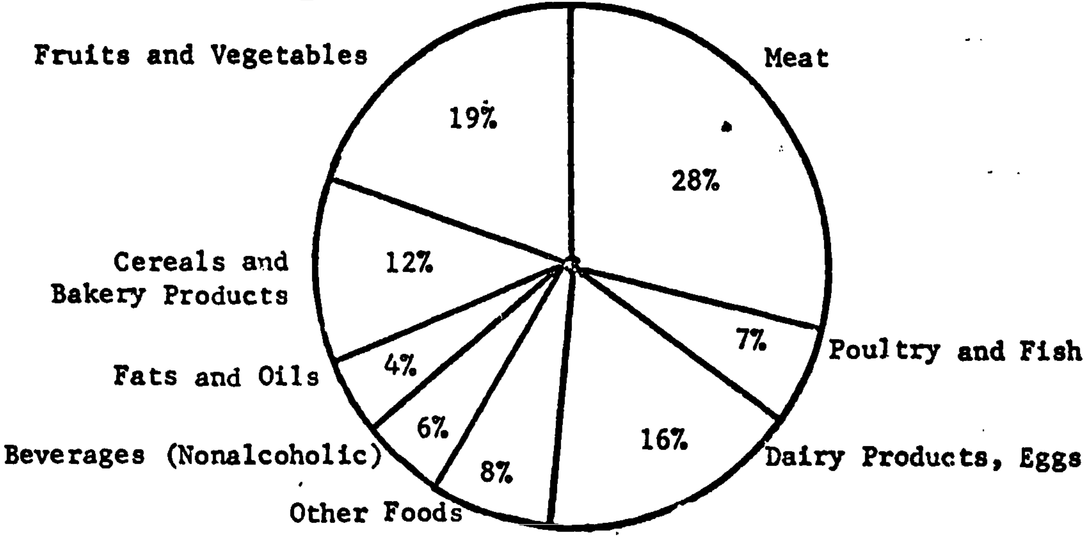
10. Read a given chart, graph, map or meter and interpret the information.

Example: Natural gas is measured in units of 100 cubic feet. The figure below shows the dials on a common gas meter. Each mark on the dial represents 1 CCF, or 100 cubic feet. A complete revolution on that dial records 10 CCF, or 1000 cubic feet. The reading on the meter in the figure is 8234 CCF, or 823,400 cubic feet.



11. Interpret the data from a circle graph.

Example: Study the circle graph below which shows the weekly expenditures for food in an average household. If a family spends $52 per week on food, determine the amount spent on each of the different types of foods.



12. Measure the length, area, volume, mass, angle and temperature of various objects using both English and metric units.

Example: Measure the length of your classroom.

a. Use a yard stick.
b. Use a meter stick.

13. Make and use scale drawings in relevant situations.

Example: A room has a length of 5 meters and width of 3 meters. If the room is to be drawn to scale using 1 meter = 1/2 centimeter, find the measurements for the length and width to be used in the scale drawing.

FIFTH QUARTER - OBJECTIVES 14-19

14. Use banking forms such as deposit slips, checks and check book records and then reconcile bank statements.

Example: Write a check for $100.52 payable to John E. Smith using the date September 29, 1975. Then fill in the attached check stub.

No.____$__________
__________, 19__
To __________

Bal. For'd.	215	48
Deposits		
Total		
This Check		
Bal. For'd.		

No. ____ Austin, Texas __________, 19__

MIDPOINT BANK

Pay to the order of __________________ $______

__________________________________ Dollars

____

FUNDAMENTALS OF MATHEMATICS
4Q, 5Q, 6Q
MASTERY OBJECTIVES

15. Investigate the services of several banking institutions and compare them.

    Example: a. Find the rates of interest on savings accounts of a bank, a credit union and a savings and loan association. Determine the least amount of interest lost on an initial deposit of $100 when withdrawn 4 months after deposit.

    b. Compare the advantages of using a regular account, travelers checks, certified checks and cashier's checks.

16. Investigate and compare different types of financing.

    Example: A stereo system that you want to own costs $200. Investigate the possibility of obtaining a loan for this amount from a bank, a finance company, a credit union or through a revolving charge account.

    a. Which has the smallest monthly payment?

    b. Which takes the shortest length of time to pay off?

    c. Which has the lowest total for repayment of the loan?

17. Determine the cost of food.

    Example: a. Given a list of 5 grocery items, determine their prices at 3 different stores.

    1. Find the total cost of the items at each store.

    2. If you could shop at only 2 of the 3 stores, which 2 would you use and what items would you buy at each one?

    b. Given a breakfast menu from a restaurant, make out 3 different breakfast orders and determine the cost of the food, tax (5%), tip (15% of food total) and the total cost of the breakfast orders.

    c. Given a grocery advertisement and a menu from a restaurant, compare the total cost of the same food being prepared at home and eaten out.

18. Determine the cost of an appropriate wardrobe for a chosen career.

    Example: a. List the items you would need in your wardrobe for an office job.

b. Determine the total cost of these items from a catalog or a favorite store.

19. Figure the tax on a specified amount of income by correctly filling out a federal income tax form (short form).

<u>Example</u>: Fill out a U. S. Individual Income Tax Return using the information below. Use the standard deduction and compute the tax.

Married man, wife, two children

Wages	$12,000
Dividends	300
Interest Income	300
Withholding Tax	1,500

SIXTH QUARTER - OBJECTIVES 20-27

20. Determine the cost of health insurance for your own coverage and compare that cost to the cost of medical aid.

<u>Example</u>: Suppose you are employed and you break your leg in a motorcycle accident.

a. Find the length of time you might be incapacitated and the amount of salary you would lose.

b. If your hospital stay is two weeks, what would be the total cost of your bill for the room and other services?

c. Find out if there would be other costs.

d. Would it have been cheaper to carry health insurance for one year? two years? five years?

21. Determine the cost of owning and operating a car.

<u>Example</u>: You are considering buying a car: a Hornet, Nova, Maverick or Valiant.

a. Choose the special features you want such as air conditioning, radio, power steering, power brakes, etc.

b. Find out the prices of each car with the options you have selected.

c. Find out what a used car, similarly equipped, would cost.

d. Contact several financing agencies (bank, small loan company, auto agency financing) and determine the down payment required, length of the loan, rate of interest and how it is applied, and special requirements such as cosignature and insurance.

e. Compute the total amount of money you would pay for each car at each of the financing agencies you investigated.

f. List the advantages and disadvantages of the financing agencies.

g. Contact several insurance agencies to determine the cost of liability insurance, bodily injury, property damage to others, medical payments and comprehensive insurance for damage to your car.

22. Compare to costs of different kinds of transportation.

Example: Compare costs for several kinds of transportation to and from work by private vehicle and public transportation. List the advantages and disadvantages of car pooling or cab pooling.

23. Determine take-home pay and specific deductions such as income tax and social security, given gross pay.

Example: a. Use a W-4 form and fill in the data
1. for yourself
2. for a married man with a wife and two children
3. for a blind widow who is 75 years old

b. Use withholding tax tables to determine the income tax to be deducted.

c. Figure the social security tax to be deducted.

d. Determine take-home pay.

24. Compute wages based on a hourly rate (including overtime), commission and piecework or job rate.

Example: Compute a 44-hour week's wages for a person who earns $3.10 per hour for the first 40 hours and $4.65 per hour overtime.

25. Develop a plan or budget for managing money.

Example: a. Make a budget for the income anticipated from a part-time job while you are a student.

b. Make a budget for the income anticipated from a job you could expect to have after graduation.

c. Make a budget for the income anticipated from your chosen career.

26. Compare the cost of home ownership to the cost of renting or leasing.

Example: Determine the cost of renting and of leasing a house or apartment for one year. Be sure to add the cost of utilities not included in the rental fee.

27. Compare the cost of renting a furnished apartment to that of renting an unfurnished apartment and buying or renting the furniture.

Example:
a. Find the yearly cost of renting a furnished apartment.
b. Determine the cost of furniture for a comparable unfurnished apartment.
c. Assume that the furniture purchased in part b is bought on credit and find the cost of purchasing the furniture with financing over a period of one year.
d. Find the yearly cost of renting an unfurnished apartment of comparable space. Add the cost of the furniture determined in part b.
e. Compare the costs in parts a and d and list advantages and disadvantages of each.

INTRODUCTION TO ALGEBRA 1Q, 2Q, 3Q

PURPOSE:

The purpose of this course is to strengthen the computational background of the student not currently prepared to enter the standard algebra series and to introduce and develop basic algebraic concepts. This course is designed to aid the student who (1) plans to end his formal education at the high school level (2) plans to enter junior college or (3) plans to enter a technical school, etc.

DESCRIPTION:

This course provides for an extension of fundamental concepts studied in previous courses with emphasis placed on operations with whole numbers, fractions and decimals. Algebraic concepts emphasized include the integers, variables, geometric applications, graphs on the Cartesian coordinate plane and solutions of linear equations.

INTRODUCTORY ALGEBRA 1Q, 2Q, 3Q

Content Outline

FIRST QUARTER

- I. Fundamental Operations
  - A. Whole numbers
    - 1. Addition
    - 2. Subtraction
    - 3. Multiplication
    - 4. Division
    - 5. Operations and their properties
    - 6. Factoring composite numbers into a product of primes
    - 7. Calculating L.C.M. and G.C.F.
  - B. Fractions
    - 1. Addition
    - 2. Subtraction
    - 3. Multiplication
    - 4. Division
  - C. Decimals
    - 1. Addition
    - 2. Subtraction
    - 3. Multiplication
    - 4. Division
  - D. Order of operations
    - 1. Problems without signs of inclusion
    - 2. Problems with signs of inclusion
      - a. Addition and subtraction
      - b. Distributive property
  - E. Integers
    - 1. Addition
    - 2. Subtraction
    - 3. Multiplication
    - 4. Division
    - 5. Distributive property
  - F. Metric System

SECOND QUARTER

- II. Variables
  - A. Monomials
    - 1. Addition and subtraction
    - 2. Multiplication
      - a. Concept of exponents
      - b. Distributive property
    - 3. Fractions (Division of Monomials)
      - a. Reduction
      - b. Multiplication
      - c. Division
      - d. Addition and subtraction with like denominators
  - B. Polynomials
    - 1. Addition
    - 2. Multiplication
      - a. Polynomial by a monomial
      - b. Binomials
    - 3. Factoring using the distributive property

    4. Subtraction
    5. Division
        a. Reducing fractions by factoring
        b. "Long" division
  C. Evaluating algebraic expressions

THIRD QUARTER

III. Problem Solving
  A. Solving linear equations and inequalities
    1. Addition
    2. Multiplication
    3. Addition with multiplication
    4. Proportions
  B. Applied problem solving
    1. Proportion
    2. Percents
    3. Calculating sequence and square roots
  C. Geometry
    1. Pythagorean Theorem
    2. Formulas
        a. Perimeter
        b. Area
        c. Volume
    3. Similar and congruent figures
        a. Identification
        b. Proportion problems
  D. Graphs
    1. Number line
    2. Coordinate graphs
    3. Reading and interpreting graphs

INTRODUCTORY ALGEBRA 1Q, 2Q, 3Q
MASTERY OBJECTIVES

FIRST QUARTER - OBJECTIVES 1-19

THE STUDENT WILL:

1. Add whole numbers less than 10,000 with and without regrouping.

   Example: 3574 + 628 + 51 + 2007 = 6260

2. Subtract any two whole numbers regrouping as many times as necessary.

   Example: 38002 - 19624 = 18378

3. Multiply any number by a number less than 1000.

   Example: 385 x 407 = 156,695

4. Divide any number by a number less than 1000.

   Example: 27 $\overline{)19116}$ = 708

5. Identify and use grouping properties in performing operations of addition and multiplication.

   Example: Match each statement with the property it illustrates:

   1. 7 + 5 = 5 + 7
   2. 3 + (5+4) = (3+5) + 4
   3. 101 · (57) = (100 · 57) + (1 · 57)
   4. 5 · (2 · 7) = (5 · 2) · 7

   a. Associative property of multiplication.
   b. Commutative property of addition.
   c. Associative property of addition.
   d. Distributive property of multiplication over addition.

   Answers: 1. b 2. c 3. d 4. a

6. Factor composite numbers.

   Example: Give the prime factorization of 225.
   225 = 3·3·5·5

7. Calculate the least common multiple and greatest common factor.

   Example: The least common multiple of 12 and 8 is 24.

   12 = 2·2·3
   8 = 2·2·2
   24 = 2·2·2·3

8. Add fractions and mixed numbers with like and unlike denominators.

   Example: 8 1/3 - 3½ = 4 5/6

INTRODUCTORY ALGEBRA 1Q, 2Q, 3Q
MASTERY OBJECTIVES

9. Subtract fractions and mixed numbers.

   Example: 8 1/3 - 4 5/6 = 3½

10. Multiply fractions and mixed numbers.

    Example: 3 1/3 x 1 1/5 = 4

11. Divide fractions and mixed numbers.

    Example: 4½ ÷ 1½ = 3

12. Add decimals to thousandths.

    Example: 27.083 + 5.97 + 421 = 454.053

13. Subtract decimals to thousandths.

    Example: 38.45 - 9.872 = 28.578

14. Multiply decimals to thousandths.

    Example: .128 x .015 = .001920

15. Divide decimals to thousandths.

    Example: $.03\overline{)12.069} \approx 402.3$

16. Simplify expressions without the aid of signs of inclusion.

    Example: 6 + 4 x 2 = 14

17. Simplify expressions containing signs of inclusion.

    Example: a. 3 + (4 - 2) -(9 - 8) = 5
    b. 3(2 + 5) - 2(4 - 1) = 15

18. Perform basic operations of addition, subtractions, multiplication and division using integers.

    Example: a. Add directed numbers: (-3) + 8 + (-4) + 1 = 2
    b. Subtract directed numbers: (-8) - (52) = -60
    c. Multiply directed numbers: (-7)(-5)(-1) = -35
    d. Divide directed numbers: (-28) ÷ 4 = -7
    e. Apply the distributive property using directed numbers: -3[4 + (-6)] - (2 + 7) = -3

19. Convert units within the metric system of measure to solve problems.

    Example: 254 cm + 1000 mm = <u>354</u> cm

SECOND QUARTER - OBJECTIVES 20-24

20. Add and subtract monomials.

Example:
a. Containing one variable
$3a + 8a + a = 12a$
b. Containing directed coefficients
$-7a + 2a - 3a = -8a$
c. Containing variables with exponents
$3a + 8b^2 + (-3b^2) + 2a = 5a + 5b^2$

21. Multiply monomials in which variables have integral exponents.

Example:
a. $(2a)(3a) = 6a^2$
b. $(3ab)(2a^2)(a^2b) = 6a^5b^2$
c. $3a(2a + a^2b) = 6a^2 + 3a^3b$

22. Perform basic operations using fractional monomial expressions

Example:
a. Simplify fractional monomials
$\frac{4(2y)}{12(y^2)} = \frac{x}{3y}$
b. Multiply monomial fractions
$\frac{2a}{b} \cdot \frac{ab^2}{a^3} = \frac{2a}{b}$
c. Divide monomial fractions
$\frac{3x}{y^2} \div \frac{6}{xy} = \frac{x^2}{2y}$
d. Add monomial fractions
$\frac{3a}{b} + \frac{4a}{b} = \frac{7a}{b}$
e. Subtract monomial fractions
$\frac{2a}{3} - \frac{b}{3} = \frac{2a - b}{3}$

23. Perform basic operations using polynomials.

Example:
a. Add two polynomials
1. $(3x + 4y + z)+(4x + 2y + z)=7x +3y + 5z$
2. $(3x - 4y - z)+(-2x + y + z)=x - 3y$
b. Multiply two polynomials
1. A monomial and a binomial
$3x(2x + 4) = 6x^2 + 12x$
2. Two binomials
$(3x + 4)^2 = 9x^2 + 24x + 16$
$(3a + b)(2a + 2b) = 6a^2 + 8ab + 2b^2$
c. Factor polynomials using the distributive property
1. $3x^2 + 6x = 3x(x + 2)$
2. $12x^2 + 4x = 4x(3x + 1)$
d. Subtract polynomials containing two or more terms
$(-3a + 2b + 8c)-(5a - 2b + c) = -8a + 4b + 7c$

e. Divide a polynomial by a monomial
   1. Using factoring
      $$\frac{3ab - 6a^2}{3a} = \frac{3a(b - 2a)}{3a} = (b - 2a)$$
   2. Using long division
      $$\begin{array}{r} 4x^2 - 3x + 1 \\ 3x\overline{)\,12x^3 - 9x^2 + 3x} \end{array}$$

24. Evaluate algebraic expressions containing variables with integral exponents.

<u>Example</u>: a. Evaluate $2x + 3y$ when $x=4$ and $y=2$.
$2(4) + 3(2) = 8 + 6 = 14$
b. Evaluate $2x^2 + 6x - 5$ when $x=3$.
$2(3)(3) + 6(3) - 5 = 6(3) + 18 - 5 =$
$18 + 18 - 5 = 31$

THIRD QUARTER - OBJECTIVES 25-26

25. Solve linear equations and inequalities.

<u>Example</u>: a. Involving addition properties
1. Solve: $x + 7 = 12$ $(x=5)$
2. Solve: $x + 3 + 8 \leqq 5 + 2$ $(x \leqq -4)$

b. Involving multiplication properties
1. Solve: $3x = 12$ $(x=4)$
2. Solve: $-x \geqq 5$ $(x \leqq -5)$

c. Involving addition and multiplication properties
1. Solve: $2x - 3 = 5$ $(x=4)$
2. Solve: $3x + 5 + 4x + 2 \geqq 0$ $(x \geqq -1)$

d. Involving proportions
Solve: $\frac{x}{5} = \frac{15}{25}$ $(x = 3)$

26. Use algebraic skills in solving applied problems.

Example: a. Involving proportions
A twelve foot tree casts a 20 foot shadow. How tall is a flagpole which casts an 80 foot shadow? 48 ft.

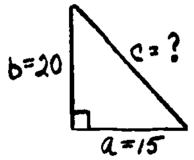
b. Involving percents
What is the sale price of a $50 radio at a 25% discount?
$50 x .25 = $12.50 discount
$50.00 - $12.50 = $37.50 sale price

c. Involving squares and square roots using tables

$25^2 = 25 \times 25 = 625$

$\sqrt{625} = 25$

d. Using concepts of geometry
   1. Involving the Pythagorean theorem
      Find the missing length.

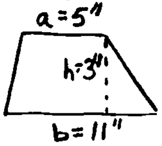


$c^2 = a^2 + b^2$
$c^2 = 15^2 + 20^2$
$c^2 = 225 + 400$
$c^2 = 625$
$c = \sqrt{625}$
$c = 25$

   2. Involving formulas
      a. Perimeters of plane figures
         Find the perimeter of the rectangle.

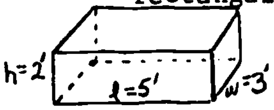
$p = 21 + 2w$
$p = 2(8') + 2(5')$
$p = 16' + 10' = 26'$

      b. Areas of plane figures
         Find the area of the trapezoid.



$A = (\frac{a + b}{2})h$
$A = (\frac{5 + 11}{2})3$
$A = 24$ sq. in.

      c. Volumes of prisms and cylinders
         Find the volume of the right rectangular prism.



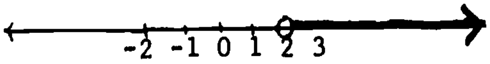
$V = l \cdot w \cdot h$
$V = 5' \cdot 3' \cdot 2'$
$V = 30$ cu. ft.

      d. Similar and congruent figures
         1. By identification
            a. Are the figures similar?
            b. Are they congruent?

         2. In a proportion problem
            Find the missing lengths.

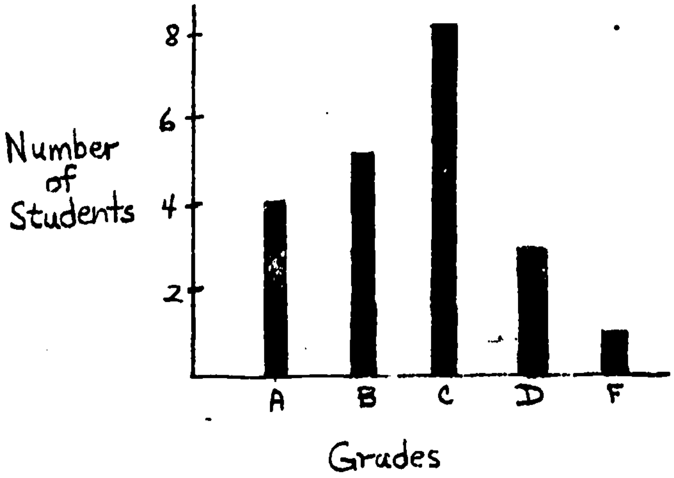
AC = 8'   EF = 15'

      e. Involving graphs
         1. On the number line
            Graph $x > 2$.



         2. On the coordinate plane
            Graph $y = 2x + 1$.

3. Reading and interpreting statistical graphs
   a. What grade was made by most students?
   b. How many students made an A or B?
   c. How many students took the test?



INTRODUCTION TO ALGEBRA 4Q, 5Q, 6Q

PURPOSE:

The purpose of this course is to provide the student with a background of formal Algebra without undue emphasis on technical terminology. It is also the purpose of this course to prepare the student to meet minimum requirements to enter a two year college or technical school, or a vocational trade in which the use of equations is essential.

DESCRIPTION:

This course includes a study of four basic operations with polynomials, factoring, solving open sentences, linear equations and inequalities, systems of equations, graphing equations, use of four basic operations with radical expressions and whole number exponents and substituting data into formulas and solving for the unknown.

This is the second part of the Introduction to Algebra course. The sequence of Introductory Algebra 1q, 2q, 3q, 4q, 5q, 6q is not intended to be equivalent to completion of Algebra 1q, 2q, 3q.

INTRODUCTORY ALGEBRA 4Q, 5Q, 6Q

Content Outline

FOURTH QUARTER

- I. Polynomials, Open Sentences, Radical Expressions
  - A. Basic operations with polynomials
    - 1. Addition
    - 2. Subtraction
    - 3. Multiplication
    - 4. Division
  - B. Solving open sentences
    - 1. Additive inverses
    - 2. Reciprocals
    - 3. Additive inverses and reciprocals
  - C. Radical expressions
    - 1. Addition
    - 2. Subtraction
    - 3. Multiplication
    - 4. Division
  - D. Factoring polynomials
    - 1. Monomial factoring
    - 2. Trinomial factoring
      - a. Difference of two squares
      - b. Perfect squares
      - c. Coefficient of x^2 is 1
      - d. Coefficient of x^2 is greater than 1
    - 3. Solving quadratic equations using the multiplication property of zero

FIFTH QUARTER

- II. Graphing, Systems of Equations, Systems of Inequalities
  - A. Graph construction
    - 1. Table of values
    - 2. Equation ($y = mx + b$)
  - B. Slope determination
    - 1. Graph of the line
    - 2. Equation ($y = mx + b$)
    - 3. Slope formula ($m = \frac{y_1 - y_2}{x_1 - x_2}$)
  - C. Solving systems of linear equations
    - 1. Graph method
    - 2. Addition method
    - 3. Substitution method
  - D. Linear inequalities
    - 1. Rearranging into slope-intercept form
    - 2. Graphing
  - E. Solving systems of linear inequalities

SIXTH QUARTER

- III. Formulas, Rational Expressions, Word Problems
  - A. Substituting values into a formula and solving for the unknown
  - B. Translating word problems into equations.

INTRODUCTORY ALGEBRA 4Q, 5Q, 6Q
MASTERY OBJECTIVES

FOURTH QUARTER - OBJECTIVES 1-4

THE STUDENT WILL:

1. Combine polynomials by using addition, subtraction, multiplication and division. (Division by a monomial, only)

   Example: a. Add: $(3x^2 - x + 2) + (x^2 + 2x - 3)$
   b. Subtract: $(6x^2 + 3x - 5) - (2x^2 - 4x + 3)$
   c. Multiply: $(x + 2)(2x - 3)$
   d. Divide: $(16x^3 - 8x^2 + 4x) \div (4x)$

2. Solve a linear equation or inequality. If the solution set is finite, verify it. If the solution set is infinite, graph it.

   Example: Find the value for y if $5y + 1 = 4y + 3$

3. Use addition, subtraction, multiplication and division to simplify radical expressions.

   Example: a. Add: $3\sqrt{2} + 5\sqrt{2}$
   b. Subtract: $7\sqrt{3} - 4\sqrt{3}$
   c. Multiply: $\sqrt{6} \cdot \sqrt{3}$
   d. Divide: $\sqrt{50} \div \sqrt{2}$

4. Factor polynomials of the form $ax^2 + bx + c$ and use the multiplication property of zero to find solutions of the equation $ax^2 + bx + c = 0$.

   Example: a. Factor: $x^2 + 12x + 20$
   b. Solve for x: $x^2 + 12x + 20 = 0$

FIFTH QUARTER - OBJECTIVES 5-10

5. Graph a linear function using a table of values or a point and the slope.

   Example: Graph $y = x + 5$ on the coordinate plane.

6. Find the slope of a linear function by using the graph of the equation, the equation itself, or two points.

   Example: Determine the slope of each line using the formula $y = mx + b$.
   a. $y = 2x + 5$
   b. $3x + y = 2$

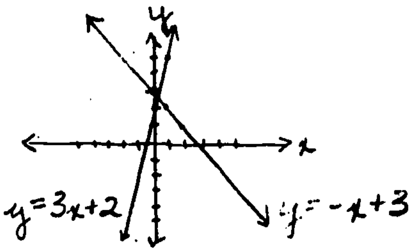
7. Determine whether the solution set of two linear equations contains no points, one point, or infinitely many points, given the graphs of the equations. If the solution set is unique, be able to find and verify it.

C. Rational expressions
  1. Addition
  2. Subtraction
  3. Multiplication
  4. Division

D. Solving equations using the quadratic formula

E. Right triangle relationships
  1. Pythagorean Theorem
  2. Trigonometric functions
    a. Tangent
    b. Sine
    c. Cosine

INTRODUCTORY ALGEBRA 4Q, 5Q, 6Q
MASTERY OBJECTIVES



Example: The graphs of $y = 3x + 2$ and $y = -x + 3$ have how many points in common?

8. Solve a system of linear equations using the addition or substitution method.

Example: Solve the system of equations for x and y.

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

9. Solve and graph linear equalities and inequalities.

Example: a. Solve: $x + 2y \geq 7 + 3x$
b. Graph: $y \leq x - 1$

10. Graph a system of linear equalities and inequalities.

Example: Graph the inequalities on the same coordinate plane.

$$y \leq 3 - x$$
$$y \geq 2x - 3$$

SIXTH QUARTER - OBJECTIVES 11-15

11. Substitute data into a formula to solve for the unknown.

Example: Using the formula $A = \frac{1}{2}bh$, substitute $b = 12$ and $h = 3$ to find the value of A.

12. Translate the numerical relationships of a word problem into an equation, solve the equation and state the solution to the word problem.

Example: If three times a number increased by one is seven, find the number.

13. Use addition, subtraction, multiplication and division to simplify rational expressions.

Example: a. Add: $\frac{4x + 1}{12} + \frac{x + 1}{6}$

b. Subtract: $\frac{x - 3}{4} - \frac{x + 2}{5}$

c. Multiply: $\frac{4x}{3} \cdot \frac{7}{10x}$

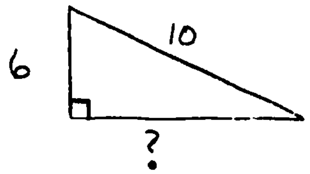
d. Divide: $\frac{x + 2}{x^2 - 4} \div \frac{x + 1}{x^2 - 4}$

14. Find rational solutions to quadratic equations with integral coefficients using the quadratic formula for use in practical problem solving.

Example: Solve for x: $x^2 + 5x + 6 = 0$

15. Use and apply the Pythagorean Theorem and the trigonometric functions to solve practical problems involving right triangles.

Example: Use the Pythagorean theorem to find the missing value.



ALGEBRA 1Q, 2Q, 3Q

PURPOSE:

The purpose of this course is to provide the student with the basic structures of algebra necessary for higher mathematics, science and technological endeavors.

DESCRIPTION:

This course includes a study of the following:

1. The structure of the number system.
2. Solutions of equations and inequalities.
3. Graphing on the number line and in the Cartesian plane.
4. Basic operations with polynomials.
5. Basic operations with rational expressions.
6. Factoring.
7. Operations with irrational numbers.
8. Basic functions and relations.

ALGEBRA 1Q, 2Q, 3Q

Content Outline

FIRST QUARTER

- I. Definition and Classification of Real Numbers
- II. Properties of Real Numbers
- III. Operations with Real Numbers
- IV. Solving Equations
- V. Stated Problems
- VI. Solving and Graphing Inequalities

SECOND QUARTER

- VII. Polynomials
  - A. Definitions
  - B. Operations (addition, subtraction, multiplication and division)
  - C. Factoring
  - D. Solving equations by factoring

- VIII. Systems of Equations
  - A. Graphing of relations and functions
  - B. Writing and graphing linear equations
  - C. Solving systems of linear equations
    - 1. graphically
    - 2. algebraically
  - D. Solving stated problems

THIRD QUARTER

- IX. Rational Numbers
  - A. Operations with rational numbers
  - B. Solving equations with rational numbers

- X. Irrational Numbers
  - A. Operations with irrational numbers
  - B. Solving equations with irrational numbers

- XI. Solving Quadratic Equations by
  - A. Factoring
  - B. Graphing
  - C. Completing the square
  - D. Quadratic formula

ALGEBRA 1Q, 2Q, 3Q

MASTERY OBJECTIVES

FIRST QUARTER - OBJECTIVES 1-16

THE STUDENT WILL:

1. Classify real numbers as integral, rational or irrational.

   Example: Integers $\{.....-3, -2, -1, 0, 1, 2, 3 .....\}$

   Rational {any number that can be expressed as a/b, $b \neq 0$}

   Irrational {any number that can not be expressed as a/b, where a and b are integers

2. Evaluate an algebraic expression using the correct order of operations.

   Example: If $x = 1$, then $\frac{3\,(x) + 5}{2} = ?$

3. Write the solution set of an open sentence with a specified finite replacement set.

   Example: Use the domain, $D = \{1,2,3\}$, to find the solution set of $x + 2 = 5$.

4. Translate verbal expressions to algebraic expressions and algebraic expressions to verbal expressions.

   Example: Write as an algebraic phrase: Three times a number plus five.

5. Determine the truth value of algebraic sentences involving real numbers.

   Example: Use the domain, D = {Real numbers}, to find the solution set of $x-7 = 10$.

6. Graph on the number line the solution set of an equation or inequality.

   Example: Graph each:
   a. $x = 3$
   b. $x > 3$
   c. $x < 3$

7. Use the properties of equality, inequalities and of the operations in simple proofs.

   Example: $2\,(x + 5) \overset{?}{=} 2x + 10$

ALGEBRA 1Q, 2Q, 3Q
MASTERY OBJECTIVES

8. Apply the trichotomy property to show the relationship between two real numbers.

<u>Example</u>: Make true statements using the symbol $<$, $>$, or $=$.

a. 2 ____ 5

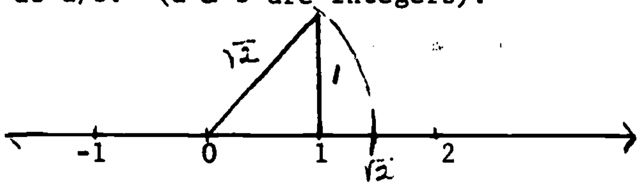
b. -3 ____ -2

c. 7 ____ 7

9. Identify and graph irrational numbers.

<u>Example</u>: An irrational number is one that can not be expressed as a/b. (a & b are integers).

$\sqrt{2}$



10. Define $|m|$ when m is a real number.

<u>Example</u>: The absolute value of a positive number and 0 is the number. The absolute value of a negative number is its oppostie.

$|9| = 9$
$|0| = 0$
$|-9| = 9$

11. Write the solution of $|x| = c$, $c \geq 0$

<u>Example</u>: If $|x| = 3$, then x = <u>3</u> or <u>-3</u>

12. Find a real number that is the additive inverse or the multiplicative inverse (reciprocal) of a number.

<u>Example</u>: a. Additive inverse of 10 is -10
b. Multiplicative inverse of 10 is 1/10

13. Use properties of inverses in computation with real numbers.

<u>Example</u>:
a. $10 + -10 = 0$
b. $10 \cdot \frac{1}{10} = 1$
c. $x + 3 + -3 = x$
d. $1/3 \cdot 3x + 7 = x + 7$

14. Use the distributive property in adding and subtracting algebraic expressions.

<u>Example</u>:
a. $2x + 3x = (2+3)x = 5x$
b. $2x - 4x = 2x + -4x = (2 + -4)x = -2x$

15. Find the solution set of equations of the form $ax + b = cx + d$.

Example: Solve for x:
$15x + 6 = 18x - 9$

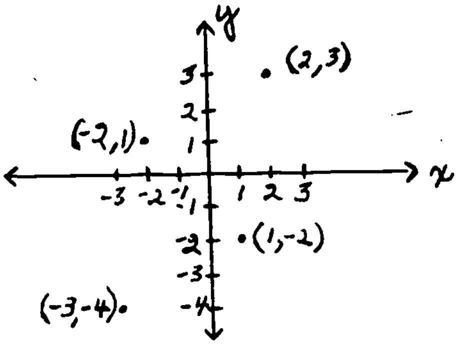
16. Write the solution set of a linear inequality and graph it on the number line.

Example: Solve and graph each:
a. $x - 4 = 10$
b. $x - 4 > 10$
c. $x - 4 < 10$

SECOND QUARTER - OBJECTIVES 17-31

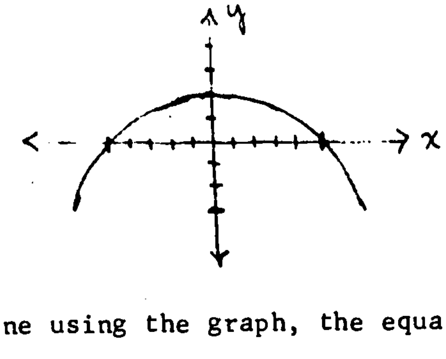
17. Use the correspondence between ordered pairs of numbers and points in a coordinate plane to locate and name points.

Example: Graph the ordered pairs (2,3), (-3,-4) (-2,1) and (1,-2).



18. Graph a relation, determine whether it is a function and give the domain and range.

Example: Give the domain and range for the following function.



19. Determine the slope of a line using the graph, the equation or two points.

Example: a. Give the slope for the following equation. $y = 5x + 3$
b. Give the slope for the line passing through (1,2) and (-3,4).

20. Determine the distance between the coodinates of two points, the mid-point of a segment joining them and check to see whether a third point lies on the line determined by the two points.

Example: a. Find the distance between these two points. (6,2) and (-4,-2)
b. Find the mid-point of the line segment connecting (5,1) and (3,-4).

21. Write the equation of a line when given two points or a point and the slope of the line.

Example: a. Write the equation for the line passing through the points (2,3) and (-1,-5).
b. Write the equation for the line passing through the point (1,-2) having a slope of 2/3.

22. Identify a system of equations as consistent or inconsistent, dependent or independent and find the solution set both graphically and algebraically.

Example: a. State whether the following system of linear equations is consistent or inconsistent. Then find the solution set and graph it on a coordinate plane.

$$2x + 3y = 8$$
$$3x + 2y = 12$$

b. State whether the following system of linear equations is dependent or independent. Then find the solution set and graph it on a coordinate plane.

$$5x - 2y = 6$$
$$y = 5/2x + 15$$

23. Find graphically the solution for a system of linear inequalities.

Example: Find the solution for $y > -x + 2$, $y > x - 2$ graphically.

24. Translate practical problems to algebraic sentences and solve them.

Example: John earned $10.00 more than Joe. Together they earned $25.00. How much did each earn?

25. Solve problems which use proportions.

Example: Solve for x: $\frac{x + 3}{5} = \frac{2x}{7}$

26. Simplify monomial and polynomial expressions which involve integral exponents.

Example: a. Simplify the following: $(3x)^3$
b. Simplify $(2x + 2)^2$

27. Determine whether an algebraic expression is a polynomial and identify the variables, coefficients and degree of the polynomial.

Example: a. What is the degree of each polynomial ?
1. $2 x^2 + 3$
2. $3x^4 + 2x^3 + 3x^2 + 2x -9$
b. Is $2x^2 + 2x + 5$ a polynomial? If so, identify the variables, coefficients and degree.

28. Use the distributive property and the laws of exponents to multiply polynomials.

Example: Multiply: $(2x +3) \quad (3x \quad -4)$

29. Find the quotient of two polynomials.

Example: Find the quotient of $x^2 - 9$ and $x - 3$.

30. Use the distributive property to factor the greatest common monomial factor from a polynomial.

Example: Factor out the common monomial factors for:
a. $12x + 6$
b. $3x^3 + 6x^2 - 12x$

31. Write a factorable binomial or trinomial as the product of prime polynomials.

Example: Factor $2a^3 + 18a^2 + 81a$ completely.

THIRD QUARTER - OBJECTIVES 32-41

32. Simplify rational expressions by dividing out common factors and naming the excluded values of the variables.

Example: a. Simplify: $\frac{3x^3 + 12x^2}{3x}$

b. What are the excluded values of x?

33. Add, subtract, multiply and divide rational expressions.

<u>Example</u>: a. $\frac{3x}{5y} + \frac{6x}{10y}$ c. $\frac{3x}{5y} \cdot \frac{6x}{10y}$

b. $\frac{4x}{5y} - \frac{6x}{10y}$ d. $\frac{3x}{5y} \div \frac{6x}{10y}$

34. Find and verify the solution for equations involving rational expressions.

<u>Example</u>: Solve for x: $\frac{3x + 5}{8} = \frac{7x + 9}{10}$

35. Use equations involving rational expressions in solving problems about motion, indirect measure, geometry and ratios.

<u>Example</u>: If a man can machine 10 studs in 15 minutes, how long will it take him to turn out 250 studs?

36. Use rational exponents to indicate roots of expressions.

<u>Example</u>: Express $x^{2/3}$ as a root.

37. Simplify expressions containing $n^{\underline{th}}$ roots by removing perfect $n^{\underline{th}}$ powers and, if necessary, rationalize the denominator.

<u>Example</u>: Simplify: a. $\frac{\sqrt{10}}{\sqrt{3}}$

b. $\sqrt{\frac{a}{b}}$

38. Add, subtract, multiply and divide radical expressions.

<u>Example</u>: a. $\sqrt{8} + \sqrt{18}$

b. $\sqrt{50} - \sqrt{18}$

c. $\sqrt{3} \cdot \sqrt{10}$

d. $\frac{\sqrt{30}}{\sqrt{10}}$

39. Find the solutions for equations containing one radical expression.

<u>Example</u>: Solve for x: $3\sqrt{x} + 4 = 10$

40. Write ordered pairs which belong to the function, graph the pairs in the coordinate plane, draw a smooth curve (parabola) through the points, read the zero of the polynomial from the graph and check them in the polynomial.

Example: Write an ordered pair for the following quadratic function: $y = 2x^2 + 5x - 10$

41. Find roots of a quadratic equation by factoring, completing the square and using the quadratic formula.

Example: Solve by using quadratic formula:
$x^2 + 6x + 5 = 0$

ALGEBRA 4Q, 5Q, 6Q

PURPOSE:

The purpose of this course is to extend and enrich concepts of the structure of Algebra and to prepare the students for higher mathematics courses, science and technological endeavors.

DESCRIPTION:

This course includes a study of the following:

1. Axioms, statements and proofs relating to linear open sentences
2. Solution of equations and inequalities
3. Sequences of real numbers
4. Linear functions and relations
5. Polynomial and rational expressions
6. Radical and irrational numbers
7. Polynomial functions and the set of complex numbers
8. Exponential and logarithmic functions
9. Quadratic systems and conic sections

ALGEBRA 4Q, 5Q, 6Q

Content Outline

FOURTH QUARTER

I. Statements, Axioms and Proofs

II. Equations

III. Inequalities

IV. Absolute values

V. Sequences and series

FIFTH QUARTER

VI. Systems of linear equations

VII. Polynomial and rational expressions

VIII. Radical and Irrational numbers

IX. Quadratic equations

SIXTH QUARTER

X. Polynomial functions

XI. Complex numbers

XII. Exponents, logarithms, numerical computation

XIII. Quadratic relations and systems

ALGEBRA 4Q, 5Q, 6Q
MASTERY OBJECTIVES

FOURTH QUARTER - OBJECTIVES 1-12

THE STUDENT:

1. Graph the conjuction and disjunction of algebraic statements.

   Example: If p is $x > 3$ and q is $x < 5$, graph
   a. conjunction $p \wedge q$
   b. disjunction $p \vee q$

2. Write in words the conditional, $p \rightarrow q$, its converse, inverse and contrapositive; state the truth value of each, if p and q are statements in words and have specific truth values.

   Example: Given: if $x = 7$, then $2x + 1 = 15$

   write
   a. the converse of the conditional.
   b. the inverse of the conditional.
   c. the contrapositive of the conditional.

3. Write in words $\sim p$, $p \wedge q$, $p \vee q$, $p \rightarrow q$, $p \leftrightarrow q$, as well as their negations, if given two statements p and q, in words.

   Example: If p represents the statement "the product of 3 and 7 is 12" and q represents the statement "the sum of 5 and 7 is 12", write in words:

   a. $\sim p$
   b. $p \wedge q$
   c. $p \vee q$
   d. $p \rightarrow q$
   e. $p \leftrightarrow q$
   f. $\sim(\sim p)$
   g. $\sim(p \wedge q)$
   h. $\sim(p \vee q)$
   i. $\sim(p \rightarrow q)$
   j. $\sim(p \leftrightarrow q)$

4. Use the truth tables for conjunction, disjunction, negation, implication and equivalence to construct truth tables for complex sentences and to identify equivalent statements, tautologies and contradictions.

Example:

p	q	$\sim p$	$\sim q$	$p \wedge q$	$p \vee q$	$p \rightarrow q$	$p \leftrightarrow q$
T	T	F	F	T	T	T	T
F	T	T	F	F	T	T	F
T	F	F	T	F	T	F	F
F	F	F	F	F	F	T	T

Identify:
a. conjunction
b. disjunction
c. conditional
d. equivalence

5. Use the quantifiers $(\forall, \exists)$ and write the negation of a quantified statement.

   Example: Write the negation for the statement "for each real number x, $x + 3 \neq 4$."

6. Use the logical methods of proof to identify a valid proof and to justify each statement in a valid proof.

   Example: Complete the following proof. Prove- For all real numbers b and c,

$$(b + c) + (-c) = b$$

Statements	Reasons
1. b and c are real numbers	1. hypothesis
2. b + c is a real number	2.
3. -c is a real number	3.
4. $(b + c) + (-c) = b + [c + (-c)]$	4.
5. $= b + o$	5.
6. $= b$	6.
7. $\therefore (b + c) + (-c) = b$	7.

7. Solve and graph equalities and inequalities involving absolute value of real numbers.

   Example: Solve, then graph the solution set for
   a. $|y - 2| \quad 3$

   b. $|x-5| = 7$

8. Find any of the following: the first term, the last term, the common difference, the number of terms, any given number of arithmetic means and the sum, when given sufficient data about an arithmetic sequence or series.

   Example: Find the sum of the even positive integers between 17 and 87.

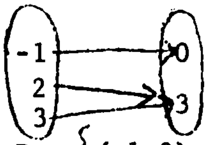
9. Find any of the following: the first term, the last term, the common ratio, the number of terms, any given number of geometric means and the sum, when given sufficient data about a finite geometric sequence or series.

   Example: Find the sum of the first six terms of the sequence 3, -6, 12, ...

10. Express the inverse of a relation in the form in which the relation is given (graph, ordered pair, rule or mapping).

   Example: Express the inverse of each relation.

   a.



   b. $R = \{(-1,0), (1,0), (3,8), (-3,8)\}$

ALGEBRA 4Q, 5Q, 6Q
MASTERY OBJECTIVES

11. Determine whether a relation is a function and state reasons for the answer.

Example: Determine whether each relation is a function. State reasons for your answer.

a. $\{(x,y) \mid y = x^2,\ x \in Re\}$

b. $\{(x,y) \mid x = y^2,\ x \in Re\}$

12. Use coordinate geometry to prove simple geometric relationships.

Example: Given points (1, -2) and (4,6),
a. Find the slope of the line containing them.
b. Write an equation of that line.
c. Determine whether (2,0) belongs to the line.

FIFTH QUARTER - OBJECTIVES 13-21

13. Solve systems of linear equations in two variables and three variables. (Note: the graph of a linear equation in 3 variables is a plane.)

Example: Solve the system of equations.

$$\begin{cases} 4x + 2y + 2z = 2 \\ -7x + 3y - 3z = 2 \\ 3x + 5y + 9z = 4 \end{cases}$$

14. Simplify polynomial expressions which involve using the laws of exponents.

Example: Simplify $(6x^2 z^{-3})^2 (-2x^{-1} z^5)$.

15. Use factoring to simplify polynomial expressions.

Example: Simplify each.

a. $\dfrac{x^2 + 5x - 6}{(x-1)(x+6)^2}$ b. $\dfrac{k^3 - 1}{2k^2 + 2k - 4}$

16. Simplify complex fractions in which the numerator or denominator or both are fractions or mixed expressions.

Example: Simplify each.

a. $\dfrac{n + 1 - 2/n}{n + 4 + 4/n}$ b. $1 + (a + a^{-1})^{-1}$

17. Solve equations involving polynomials and rational algebraic equations.

Example: Solve over the set of real numbers.

a. $\frac{1}{x} + \frac{1}{2x} = \frac{1}{6}$ b. $\frac{2}{x+1} + \frac{1}{3x+3} = \frac{1}{6}$

18. Simplify an algebraic expression containing radicals, including those with binomial denominators and indices which can be reduced.

Example: Simplify each.

a. $\sqrt{3/4} \cdot \sqrt{44/3}$

b. $\sqrt[4]{9gh^4} \cdot \sqrt[4]{27gh}$

c. $2/3\sqrt{108} - 13/2\sqrt{128} + \sqrt{192}$

19. Find and verify the solution set of an equation containing radical expressions.

Example: Find and verify solution sets for each.

a. $\sqrt[3]{s^2 + 2} - 3 = 0$

b. $\sqrt{k - 5} = \sqrt{k} - 1$

20. Develop and use the quadratic formula to find exact and approximate solutions for equations.

Example: Find solutions for each.

a. $6n^2 + 10n + 3 = 0$ b. $3n^2 + 8n + 2 = 0$

21. Write a quadratic equation when given sufficient information about the roots.

Example: Write equations whose roots are:

a. $\{5, -7\}$

b. $\{1 \pm \sqrt{5}\}$

SIXTH QUARTER - OBJECTIVES 22-40

22. Given the quadratic function $f(x) = ax^2 + bx + c$: draw the graph, describe the role of the constants a, b and c, find the vertex, find the axis of symmetry and estimate the zeros.

Example: Given the quadratic function $f(x) = x^2 + x - 12$,

a. Sketch the graph.
b. Describe the roles of a, b, c.
c. Find the vertex and the axis of symmetry.
d. Estimate the zeros.

23. Determine the value of the discriminant of a quadratic function and use its value to describe the zeros of the function, the placement of the graph with respect to the x-axis, and the roots of the corresponding equation.

Example: Determine the nature of the roots of $-7s^2 + 9s - 3 = 0$.

24. Identify and simplify expressions involving pure imaginary numbers.

Example: Simplify each.

a. i^{14}

b. $\sqrt{-9} \cdot \sqrt{-3}$

c. $i + 2i^2 + 3i^3 + i^4$

25. Simplify an expression involving addition, subtraction and multiplication of complex numbers and write the result in standard form.

Example: Simplify and write in standard form:

$(7 - \sqrt{-2})^2 + 14\sqrt{2}\ i$

26. Use the conjugate of a complex number to write the quotient of two complex numbers in standard form.

Example: Simplify $\frac{2 + i}{3 - i}$.

27. Use synthetic division, the Fundamental Theorem of Algebra, the Factor Theorem, and the Rational Root Theorem to find, over the set of rationals, the zeros of a polynomial function, the roots of a polynomial equation, or the factors of a polynomial expression.

Example: a. Use the Factor Theorem and synthetic division to show that the first polynomial is a factor of the second.

$x - 3; \quad 2x^3 - 11x^2 + 12x + 9$

b. Find the solution set of

$x^3 - 6x^2 + 11x - 6 = 0$

28. Write an expression containing radicals as an equivalent expression containing rational exponents, and conversely.

Example: a. Simplify and express in simple radical form.

$\sqrt{8} \cdot \sqrt[4]{32}$

b. Simplify and express in exponential form, where all exponents are positive.

$\sqrt[3]{16a^5b^6}$

c. Write in radical form.

$7^{1/3}\ a^{1/6}\ b^{-2/3}$

29. Graph an exponential function and its inverse on the same axes.

<u>Example</u>: Sketch the graphs of each.

a. $y = 2^x$

b. $y = \log_2 x$

30. Change an equation from logarithmic to exponential form, and conversely.

<u>Example</u>: Solve for x in

$\log_x 125 = 3$

31. Use common logarithms to solve problems involving multiplication, division and exponentiation.

<u>Example</u>: Compute each.

a. $\frac{(0.813)^2}{\sqrt{0.817}}$

b. $(0.04881)^{1/6}$

32. Solve simple logarithmic and exponential equations with and without tables.

<u>Example</u>: Solve for x.

$\log x = 1/3 \left[2 \log 8 - 6 \log 3\right] - 2 \log 2 + \log 3$

33. Given the coordinates of two points in space, determine the distance between them and the midpoint of the segment joining them.

<u>Example</u>: Given the points P and Q whose coordinates are $(3,\ 2\sqrt{3})$ and $(4, \sqrt{3})$ find.

a. the length of $\overline{PQ}$

b. the coordinate of the midpoint of $\overline{PQ}$

ALGEBRA 4Q, 5Q, 6Q
MASTERY OBJECTIVES

34. Graph the equation of a circle, an ellipse, a parabola and a hyperbola and identify the important parts of each.

Example: Sketch the graph of each.

a. $4x^2 + 4y^2 = 36$

b. $36x^2 + 9y^2 = 324$

c. $49y^2 - 4x^2 = 196$

d. $x = -2y^2$

35. Identify the conic represented by an equation of the form $Ax^2 + Cy^2 + Dx + Ey + F = 0$.

Example: Identify the conic represented by

$$x^2 + y^2 - 4x + 2y - 4 = 0$$

36. Write the equation of a parabola and circle from the locus definitions.

Example: Write equations for each.

a. the parabola with focus, $F = (0,3)$, and directrix = 1

b. the circle with center, $c = (4,5)$, radius = 7

37. Graph an inequality whose boundary is one of the conics in standard form.

Example: Sketch the graph of $x^2 + y^2 \leq 4$.

38. Graph a quadratic system of two equations in two variables, give the number of real solutions and approximate the solution set.

Example: a. Graph the system.

$$\begin{cases} x^2 + 4y^2 = 17 \\ 3x^2 - y^2 = -1 \end{cases}$$

b. Give the number of real solutions.
c. Approximate the solution set.

39. Graph a quadratic system of two inequalities in two variables and indicate the solution set.

Example: a. Graph the system,

$$\begin{cases} x^2 + y^2 \geq 4 \\ x^2 + 9y^2 \leq 9 \end{cases}$$

ALGEBRA 4Q, 5Q, 6Q
MASTERY OBJECTIVES

40. Solve a quadratic system of two equations in two variables algebraically.

Example: Solve the system algebraically.

$$\begin{cases} x^2 + 2y^2 = 17 \\ 2x^2 - 3y^2 = 6 \end{cases}$$

ALGEBRA 4Q, 5Q, 6Q
MASTERY OBJECTIVES
FOR HONORS AND HIGH ACADEMICS
STUDENTS ONLY

These objectives may be included at anytime the teacher wishes:

1. Solve a system of equations using determinants or matrices.

(1) $\begin{cases} 5x - 6y = 3 \\ 2x - 3y = 1 \end{cases}$ (6,3)

(2) $\begin{cases} 6a + 9b = 8 \\ 9a - 3b = 1 \end{cases}$ (1/3, 8/9)

(3) $\begin{cases} 2x - 3y = 0 \\ 2x + y = 4 \end{cases}$ (3/2, -1)

(4) $\begin{cases} 2p + 2q + r = 1 \\ p + 3q - r = 0 \\ -3p + q + 2r = 4 \end{cases}$ (-1/2, 1/2, 1)

2. Use graphs of linear inequalities to solve problems in linear programming.

A manufacturer wishes to produce two commodities A and B.

The number of units of material, labor and equipment needed to produce one unit of each commodity is shown in the following table. Also shown is the available number of units of each of the items, material, labor and equipment.

	A	B	Available
Material	1	2	8
Labor	3	2	12
Equipment	1	1	10

(1) Find the maximum profit if each unit of commodity A earns a profit of \$2 and each unit of B earns \$3.

\$13 answer

(2) Find the maximum profit if each unit of A earns a profit of \$3 and B earns \$2.

\$12 answer

3. Determine whether an infinite geometric series has a sum and, if so, find it.

(1) $9/10 + 9/10^2 + 9/10^3 + \ldots$ answer:1

(2) $3/4 - 1/2 + 1/3 - 2/9 + \ldots$ answer: 9/20

4. Identify the conic represented by an equation of the form $Ax^2 + Cy^2 + Dx + Ey + F = 0$.

Put equations in graphing form and graph:

(1) $x^2 + y^2 + 6x - 10y + 24 = 0$

(2) $x^2 + 4y^2 - 2x - 16y + 13 = 0$

(3) $9x^2 - 16y^2 - 54x + 64y - 127 = 0$

(4) $4x^2 + 8x - y + 7 = 0$

GEOMETRY 1Q, 2Q, 3Q

PURPOSES:

The major purposes of this course are to provide a thorough knowledge of the main topics of plane and solid geometry as listed in the course description, to clarify the meaning of a mathematical system, to emphasize the meaning of deductive reasoning and of mathematical proofs and to give experience in presenting an argument in a clear, orderly fashion.

DESCRIPTION:

This course provides an introduction to a mathematical system which uses undefined terms, definitions, postulates and theorems in the study of plane and solid figures. Special topics to be emphasized are as follows:

1. Congruences and similarities of triangles.
2. Parallel and perpendiculiar properties of lines and planes.
3. Areas of polygons and volumes of geometric solids.
4. Properties of circles and related solids.
5. Special right triangle relationships.
6. Inequalities in one or more triangles.
7. Coordinate geometry.

GEOMETRY 1Q, 2Q, 3Q

Content Outline

FIRST QUARTER

- I. Basic Geometric Foundations
  - A. Sets, real numbers, lines, planes
  - B. Basic assumptions
    - 1. Belonging Postulate
    - 2. Betweenness Postulate
    - 3. Distance Postulate
    - 4. Betweenness - Distance Postulate
    - 5. Mid-point Postulate

- II. Lines, Planes and Separation
  - A. Definitions
  - B. Fundamental postulates
    - 1. Plane Postulate
    - 2. Plane Separation Postulate
    - 3. Space Separation Postulate

- III. Angles and Triangles
  - A. Definitions
    - 1. Angle
    - 2. Half plane
    - 3. Triangle
  - B. Angle measure postulates
    - 1. Angle Measurement Postulate
    - 2. Angle Construction Postulate
    - 3. Angle Addition Postulate
    - 4. Supplement Postulate

- IV. Congruences
  - A. Basic concepts of congruence
    - 1. Figures
    - 2. Line segments
    - 3. Angles
  - B. Theorems in the form hypothesis - conclusion
  - C. Writing basic proofs
    - 1. Right angles
    - 2. Perpendicularity
    - 3. Angle congruences
  - D. Basic congruence postulates for triangles
    - 1. ASA
    - 2. SSS
    - 3. SAS
  - E. Special triangular congruences
    - 1. Isosceles
    - 2. Equilateral
    - 3. Right
    - 4. Overlapping
  - F. Angle Bisector Theorem
  - G. Perpendicular Bisector Theorem
  - H. Use of auxiliary sets in establishing congruences

GEOMETRY 1Q, 2Q, 3Q

SECOND QUARTER

V. Geometric Inequalities
  A. Numbers, segments, angles
  B. Exterior Angle Theorem
  C. Congruence theorems based on the Exterior Angle Theorem
    1. SAA Theorem
    2. Hypotenuse - Leg Theorem
  D. Inequalities in a triangle
    1. If two sides of a triangle are not congruent, then the angles opposite them are not congruent and the larger angle is opposite the longer side.
    2. The sum of the lengths of any two sides of a triangle is greater than the length of the third side.

VI. Perpendicular Lines and Planes in Space
  A. Definition of perpendicularity for lines and planes
  B. Basic theorems on perpendiculars
  C. Existence and uniqueness
  D. Perpendicular lines and planes

VII. Parallel Lines
  A. Conditions that guarantee parallelism
  B. Parallel Postulate
  C. Parallel in space
  D. Angles formed by planes

VIII. Polygonal Regions and Areas
  A. Definitions
  B. Postulates
  C. Areas of triangles and quadrilaterals
  D. Areas of polygonal regions
  E. Special triangle relations
  F. Pythagorean Theorem

THIRD QUARTER

IX. Similarity
  A. Definitions
  B. Similarity between triangles
  C. Basic Proportionality Theorem
  D. Areas of similar triangles

X. Coordinate Geometry
  A. Definitions
  B. Slope of a non-vertical line
  C. Graphs and equations

XI. Circles and Spheres
  A. Definitions
  B. Tangent lines to a circle
  C. Tangent lines to a sphere
  D. Arcs and inscribed angles
  E. Power of a point with respect to a circle

    - 1. Secant segments
    - 2. Tangent segments
  - F. Measure relating to circles
  - G. Area of a circular region

- XII. Volumes and Solids
  - A. Volumes of prisms and pyramids
  - B. Cavalieri's Principle
  - C. Cylinders and cones
  - D. Volumes of spherical regions

GEOMETRY 1Q, 2Q, 3Q

MASTERY OBJECTIVES

FIRST QUARTER - OBJECTIVES 1-6

THE STUDENT WILL:

1. Become familiar with undefined terms, definitions, postulates and constructions as the basis for developing our study of Geometry and use a one-to-one correspondence.

   Example: A,B,C, are three points of a line. AC=BC=5. The coordinate of C is 8 and the coordinate of A is greater than the coordinate of B. What are the coordinates of A and B?

2. For a given sequence of statements (a) determine whether the sequence is logical and each conclusion is valid, (b) arrange the sequence in a logical order, (c) use postulates, definitions and previously proved theorems to justify each statement.

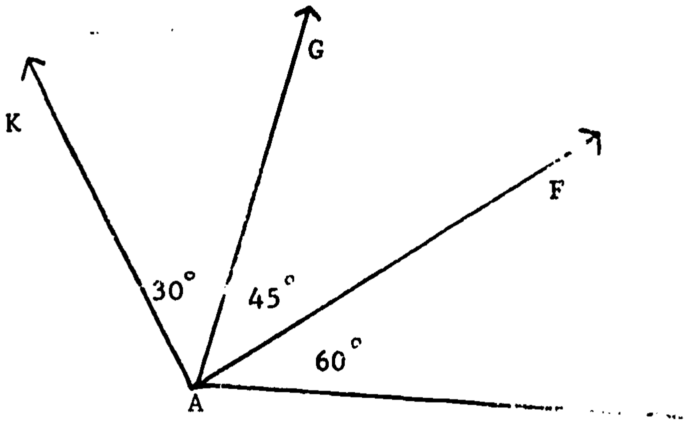
   Example: If $\overleftrightarrow{AB}$ and plane F have points K and M in common, what can you conclude about $\overleftrightarrow{AB}$ and F? Why?

3. Identify the hypothesis and conclusion of a statement and write the converse of a statement.

   Example: Write in "if-then" form: "The intersection of two planes is a line".

4. Use definition of an angle and postulates to solve problems and prove theorems about special kinds of angles and special pairs of angles.

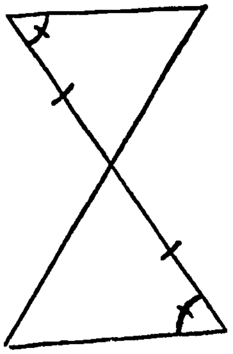
   Example: In the figure at right, name a pair of complementary angles.



5. Using postulates, definitions and previously proved theorems, prove and/or apply statements about congruent figures.

MASTERY OBJECTIVES

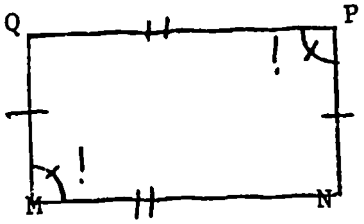
Example: Using like markings to indicate congruent parts, name the congruence postulate which will prove the triangles congruent.



6. Understand existence and uniqueness theorems about points, rays, lines and planes and how they apply to auxiliary sets.

Example: Given the figure as marked, prove

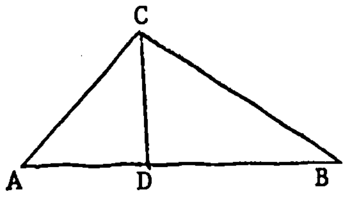
$\angle M \cong \angle P$



SECOND QUARTER - OBJECTIVES 7-11 OR 12

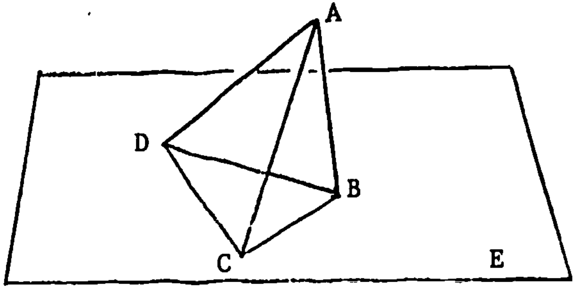
7. Apply the algebraic order properties of inequalities and indirect proof to prove theorems about geometric inequalities.

Example: Given the figure with AD = BC. Prove that AC>DB.



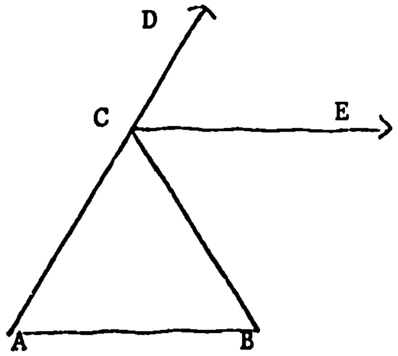
8. Using postulates, definitions and previously proved theorems, prove and/or apply statements about perpendicular lines and planes.

Example: In the figure, $\overline{AB} \perp \overline{BC}$, $\overleftrightarrow{DB} \perp \overline{BC}$, and AB = DB. Prove that $\triangle ABC \cong \triangle DBC$. Is $\overline{AB} \perp E$? Why or why not?



9. Using postulates, definitions and previously proved theorems, prove and/or apply statements about parallel lines and planes.

Example: In the figure, AC = BC and $\angle DCE \cong \angle B$. Prove $\overrightarrow{CE} \parallel \overline{AB}$.

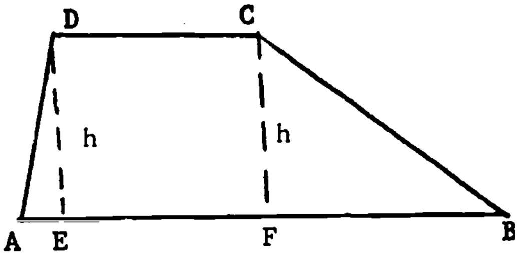


GEOMETRY 1Q, 2Q, 3Q

MASTERY OBJECTIVES

10. Use the area postulates to prove theorems and solve problems about areas of polygonal regions.

    Example: □ABCD is a trapezoid with parallel sides $\overline{AB}$ and $\overline{CD}$. If AB = 15, DC = 8, BC = 10 and m∠B = 30, then a□ABCD = ?



11. Solve problems and prove theorems about special right triangles.

    Example: The measure of each base angle of an isosceles triangle is 30, and each of the two congruent sides has length 14. How long is the base? What is the area of the triangle?

12. Define prisms, cylinders, cones, pyramids and spheres, label the significant parts and solve problems involving their areas, volumes and lengths of important line segments.

    Example: Find the surface area and the volume of a sphere whose radius equals four (4).

THIRD QUARTER - OBJECTIVES 12 OR 13-17

13. Use postulates and definitions about similarity to prove theorems and solve problems about (a) similar figures, their corresponding parts and their areas and volumes and (b) proportional line segments in a plane and in space.

    Example: Prove: If D and E are mid-points of $\overline{AC}$ and $\overline{BC}$, respectively, in △ABC then △CDE ≅ △CAB.

14. Set up a one-to-one correspondence between the set of points in the "XY - plane" and the set of ordered pairs of real numbers. Use coordinate geometry to derive and apply slope, mid-point and distance formulas and to solve problems and prove theorems.

    Example: A triangle has vertices A (5,7) B (2,0) and C (5,-3). Find the altitude to the longest side and find the area of the triangle.

15. Prove theorems and solve problems about radii, chords, tangents and secants for circles and spheres.

    Example: In a circle whose radius is 10 inches, a chord is 6 inches from the center. How long is the chord?

MASTERY OBJECTIVES

16. Use the definition of a regular polygon to solve problems about its angles, perimeter and area.

    Example: How many sides has a polygon if the measure of an exterior angle is 72 ?

17. Prove theorems and solve problems about circumference, area, angle and area of a circle.

    Example: Find the circumference and area of a circle whose radius is three (3).

COMPUTER MATHEMATICS 1Q, 2Q, 3Q

PURPOSE:

The major purposes of this course are:

(1) To acquaint the student with the development of the computer,

(2) To teach the student one or more computer languages,

(3) To all the students to solve mathematical problems with the aid of the terminal and the Time-Sharing System,

(4) To prepare the student to use a computer to solve problems of practical applications and

(5) To give the student another tool in solving mathematical problems, rather than to prepare the student to become professional programmers.

DESCRIPTION:

This course includes a study of the following:

(1) History, development, and uses of computers.

(2) Flowcharting

(3) Terminal usage.

(4) Time-sharing system commands.

(5) Writing programs using the BASIC language.

(6) Writing programs using the FORTRAN language.

(7) Practical applications in mathematics, science, engineering, and business.

(8) Vocabulary pertaining to computer terminology.

COMPUTER MATHEMATICS 1Q, 2Q, 3Q

Content Outline

FIRST QUARTER

I. History of and Introduction to Computers

- A. Distinguishing characteristics
    1. Speed
    2. Internal memory
    3. Stored program and data
    4. Input/output capabilities

- B. Development
    1. Central processing unit (CPU)
    2. Storage
    3. Monitor
    4. Compiler

- C. Types of Computers
    1. Digital
    2. Analog

- D. Computer Languages
    1. Machine
    2. Symbolic
    3. Algorithmic

II. Programmable Calculators (Optional)

- A. Programma
- B. Big Sam

III. Flow Charts, Terminal Use, and Time Sharing

- A. Fundamental symbols
- B. Pictorial analysis of instructions for performing a task
- C. Basic features of the terminal
    1. Keyboard and special characters
        - a. CTRL-E
        - b. BREAK
        - c. LINE FEED
        - d. RUB OUT
        - e. RETURN
        - f. HERE IS
        - g. Delete a line (shift 1)
        - h. Delete a character (shift 7)

    2. On-Off switch
- D. Telephone communication and phone numbers
- E. Log on/log off procedures
- F. Meaning of time-sharing

IV. Introduction to the Language of BASIC
- A. Notation convention
  - 1. Lower case letters
  - 2. Upper case letters
  - 3. BASIC characters

- B. Constants
- C. Variables
- D. Expressions and order of evaluation
  - 1. Arithmetic expressions
  - 2. Relational expressions
  - 3. Evaluable expressions

V. Statements in BASIC I
- A. Writing programs in BASIC
- B. PRINT statements and floating point
- C. END statement
- D. LET or assignment statement
- E. INPUT statement
- F. GO TO statement
- G. REM statement
- H. Mathematical functions - ABS, INT, SQR, RMD

VI. Error Messages

VII. CANDE Commands I
- A. MAKE(M)
- B. BYE
- C. LIST(L)
- D. GET(G)
- E. HELLO(HELL)
- F. RUN(R)
- G. SAVE(SA)
- H. SEQ(S)
- I. TYPE(TY)
- J. ?STATUS

VIII. BASIC Input and Output
- A. Print formats
  - 1. Zoned
  - 2. Packed
  - 3. Compressed

- B. Vertical spacing
- C. TAB function
- D. String variables (alphanumeric data)
  - 1. Assigning strings
  - 2. String variables in PRINT statements
  - 3. Comparing strings

SECOND QUARTER

IX. Basic Statements II
- A. IF-THEN statements
- B. Loops and counters
- C. FOR-NEXT statements (and STEP) NESTED LOOPS
- D. READ and DATA statements - RESTORE
- E. Additional mathematical functions - SIN, COS, TAN, LOA, ATM, EXP
- F. Defining functions and GOSUB
- G. Applications

X. CANDE Commands II
- A. FIND
- B. REPLACE (REP)
- C. TAPE (TA)
- D. LIST: PUNC" (L:P)
- E. RESEQ (RES)
- F. FIX (F)
- G. REMOVE (REM)
- H. TITLE (TI)
- I. LFILES (LFIL)
- J. FILES (FILES)
- K. WHAT

XI. Applications
- A. Sequences
- B. Series
- C. Additional topics (optional)

XII. BASIC statements III
- A. Subscripted variables
  - 1. One-dimensional arrays
  - 2. Two-dimensional arrays
- B. DIM statements
- C. MAT READ statements
- D. MAT INPUT statements
- E. MAT PRINT statements
- F. CON, ZER, and IDN
- G. STOP statement
- H. ON statement

XIII. CANDE COMMANDS III
- A. DELETE (DEL)
- B. MERGE (MER)
- C. RMERGE (RME)
- D. MOVE (MO)
- E. SECURITY (SEC)
- F. ?SS
- G. ?STATUS
- H. ?END
- I. UPDATE (UP)
- J. INSERT (IN)

XIV. Files (optional)

THIRD QUARTER

XV. Introduction to the FORTRAN Language Using the Time-Sharing System.
  A. FORTRAN - A high level language
  B. Special characters
  C. Constants
    1. Fixed point-integer constant.
    2. Floating point-real constant.
  D. Variables and variable names
    1. Names for fixed point variables
    2. Names for floating point variables
  E. Operations and expressions

XVI. Arithmetic Statements and Functions
  1. FORTRAN arithmetic statements and characters
    1. Components of arithmetic statement
    2. Mode
    3. Alphabetic
    4. Numeric
    5. Alphameric
  B. FORTRAN arithmetic
    1. Approximations
    2. Truncation

VII. Writing Simple FORTRAN Programs Using Slash (/) Format for Input and Output (I/O)
  A. READ statement
  B. PRINT statement
  C. STOP, CALL EXIT AND END statements
  D. Statement numbers and line numbers
  E. Examination of an illustrative program
  F. Writing programs in FORTRAN
  G. Mathematical functions.

III. Writing FORTRAN programs using FORMAT statements
  A. Iw format-Integer
  B. Fw.d format-External fixed point
  C. Ew.d format-Floating point
  D. wHs format-Hollerith
  E. nX format-Skip field
  F. NAw format-Alphanumeric
  G. String variables using 's'
  H. Formatted READ
  I. Formatted PRINT
  J. Practice in writing FORTRAN program using formatted I/O

XIX. Transfer of Control
  A. GO TO statement
    1. Unconditional
    2. Conditional
  B. IF statement
    1. Arithmetic IF
    2. Logical IF and relational operators
  C. Flowcharts

XX. The DO statement
  - A. Indexing parameters
  - B. DO statement rules
  - C. CONTINUE statement
  - D. Nested DOs

XXI. Subscripted Variables
  - A. One-dimensional arrays
  - B. Elements
  - C. Subscripts
  - D. DIMENSION statement
  - E. Two-dimensional arrays
  - F. DATA statements with subscripted variables and implied Dos

XXII. Subprograms
  - A. Arithmetic statement function
  - B. FUNCTION subprogram
  - C. SUBROUTINE subprogram

COMPUTER MATHEMATICS 1Q, 2Q, 3Q
MASTERY OBJECTIVES
FIRST QUARTER - OBJECTIVES 1-10

THE STUDENT WILL:

1. Write a short paragraph on the history and development of computers.

   Example: Name 5 people who contributed to the development of the computer.

2. Give the basic characteristics of a computer.

   Example: List at least three aspects of the computer which makes it a viable tool in modern day research and bookkeeping.

3. List two types of computers and three computer languages.

   Example: Two types of computers (analog and digital) and three language Algol, Cobol, Fortran.

4. Draw flow charts both simple and complex including loops.

   Example: Draw a flow chart to compute $y = X^2 + 4$ and print answer.

5. Operate a terminal.

   Example: Log-on, run a simple program, log-off.

6. Compute numerical value of an arithmetic expression following the "hierarchy of operations."

   Example: What is the answer for 4* 2 + 3** 2?

7. Write a computer program that will solve an arithmetic problem

   Example: Write a BASIC program that computes and prints $y = X^2 + 4x + 17$. Enter into a computer, run, list and save.

8. Write a program segment that would generate a specific number of random integers in specific range of values.

   Example: Write a program segment that would generate 10 random numbers from 1 to 20.

9. Modify a given program to accept alpha responses for the purpose of branching to alternate outcomes.

   Example: Change a given program so a user may run the given program repeatedly.

10. Write a program that prints required information.

    Example: Program your name, age, address, etc

COMPUTER MATHEMATICS 1Q, 2Q, 3Q
MASTERY OBJECTIVES
SECOND QUARTER - OBJECTIVES 11-20

11. Write a program using a counter to repeat an operation.

Example: Write a program that repeats itself 4 times.

12. Write a program that uses nested loops and transfers control outside the loop with a decision statement.

Example: Write a program that reads a set of data with one loop - have the inner loop do calculations with values until a certain value is recorded.

13. Write a program to read two or more items from a DATA statement.

Example: Read 10 numbers and calculate their sum and print the answer.

14. Write a program using trigonometric and logarithmic functions.

Example: Write a program to calculate $y = (\text{sun } x + \cos^2 x) + \log x$

15. Write a program using GOSUB.

Example: Write a program to input values for g and h such that $g \neq h$. Calculate a, b and c as follows:

$$a = g + h \quad b = g^2 - h \quad c = h - g$$

Use GOSUB to calculate roots of the quadiofic $a^2 + b\,x + c$.

16. Use candy commands to edit a program.

Example: Attempt to run the following program

```
100 INPUT X
110 Y = X**2 + 7**
120 PIRNT  X, "Y = Y
130 END
```

Correct the program using edit commands such as REPLACE or FIX or by retyping the line(s) and save the program.

17. Punch a program on paper tape, enter the program into the computer from tape and run the program.

Example: Load the program in #16 above, resequence, punch on tape, remove, and re-enter the program from tape, and list all files under your user code.

18. Write a summation program.

Example: Write a program to sum the first 10 elements of the sequence $y = \sum_{i=1}^{10} (ni^2 + ni + 1)$ such that $n_1 = 1.1$ & $\Delta n = .1$

19. Use arrays and subscripts to analyze data.

Example: Given the following set of data $\{1, 8, 4, 7, 3, 1.6, 0, 2, 101, 10\}$ rearrange in ascending order and print.

20. Dimension arrays and use MAT statements.

Example: Dimension two 5 x 5 arrays, read data into each array using MAT READ, find the sum of the two matrices and print sum using MAT PRINT.

COMPUTER MATHEMATICS 1Q, 2Q, 3Q
MASTERY OBJECTIVES
THIRD QUARTER - OBJECTIVES 21-30

21. Identify integer and real constants.

Example: Which of the following are permitted integer constants and which are permitted real constants? 24, .015, 2.65, 4., $\sqrt{6.2}$, -.0111, 34789.40371125, 1.2A6, -80

22. Identify variable names for fixed point and floating point numbers.

Example: Which of the following are permitted integer values? Which of the following are permitted floating point values?
FROGS, HØP, OVER, THE, LILY, PØND, IFRØG
HOPI, UHØP, TAPPP, HE LLO

23. Write FØRTRAM statements from mathematical statements.

Example: Write a FORTRAM statement for the following mathematical statements.
1. $y = (X^2 + 2X)^2$
2. $B = (A + C) / (A - D)$
3. $y = a (b - 1)$

24. Use slash (/) format for Input/Output (I/O)

Example: Write a complete FØRTRAN program to evaluate the following using slash (/) input and output.
$x = 2.5$
$y = X^2 + 4X - 1$
print x and y.

25. Use FØRMAT statements for Input/Output.

Example: Use example #24 above with F4.1 output for X and E14.4 output for y. Separate the fields with 5X skip field.

26. Control flow of program by use of GØTØ and IF statements.

Example: Write a complete FORTRAN program to perform the following task: Read a value of X with slash (/) format, calculate y according to $y = \frac{X^2 + X}{3} - 3$, calculate Z according to $Z = y^z + y$ if $y \geq 0$ or $Z = 2y^z + 3$ if $y < 0$. Print answer and go to input statement.

27. Repeat a given arithmetic operation using the DØ statement.

Example: Write a DØ statement to initialize I as 1, terminate at 100 and increment by 2.

<u>third</u> <u>quarter</u> <u>cont</u>.

28. Work with one-dimensional subscripted arrays.

<u>Example</u>: Write a program which reads in 20 pieces of data/ call data a_1, a_2, a_3-----a_{20}), immediately prints this array out, and then prints out the sequence: a_{20}, $a_{20} + a_{19}$, a_{20} + a19 + a_{18} -------, $a_{20} + a_2 + a_1$

29. Input data into two-dimensional arrays using implied DØ - loops.

<u>Example</u>: Write a FORTRAN which reads 5 interest rates and 5 principals into a 2 x 5 array, calculate the interest for each pair of interest and principals values. Print results in columns with appropriate headings for principal, rate, and interest using F8.2 format for numeric output.

30. Write a FORTRAN subprogram.

<u>Example</u>: Use a subroutine program to compute compound interest using dummy variables.

MATHEMATICS OF CONSUMER ECONOMICS
1Q, 2Q, 3Q

PURPOSE:

This course in consumer mathematics is designed to provide the student with the necessary skills to apply mathematical concepts and procedures in solving problems of daily life. Major emphasis is placed on the analysis of consumer problems, leisure activities and hobbies.

DESCRIPTION:

This course includes a study of the following:

1. Personal income and benefits
2. Banking, saving and borrowing
3. Expenditures
4. Investments and personal needs and budgeting

This course is recommended for all students and can be taken in conjunction with other mathematics courses by any student with two years of high school mathematics credit.

MATHEMATICS OF CONSUMER ECONOMICS
1Q, 2Q, 3Q

Content Outline

FIRST QUARTER:

I. Organization and the Interpretation of Data
   A. Graphs, charts and tables
   B. Review of basic skills with emphasis on speed and mental computation

II. Cost Comparisons of Personal and Commercial Transportation
   A. Automobile ownership
      1. Automobile insurance
         a. Liability
         b. Collison
      2. Operating costs
      3. Depreciation
      4. Cost of license plates
   B. Commercial transportation
      1. Renting a car
      2. Traveling by bus, railroad or air

III. Purchasing of Consumer Goods
   A. Food
   B. Clothing
   C. Computing the discount and discount rate on a purchase
   D. Seasonal and discount buying

IV. Housing
   A. Leasing and/or renting
   B. Home ownership
      1. Furniture expense
      2. Utility expense
      3. Home loans
      4. Insurance
   C. Types of shelter available

SECOND QUARTER:

V. Money Management
   A. Income
      1. Wages
      2. Interest on money, commissions
      3. Social security deductions and taxes
      4. Unemployment and disability
      5. Income tax deduction
   B. Budgeting

VI. Credit Financing
   A. Charge accounts
   B. Installment purchasing and interest rate

- C. The small loan agency
- D. The pawnshop loan
- E. The credit-union loan

VII. Taxation
- A. Federal or state income taxes
- B. Property taxes
- C. Sales and excise taxes

THIRD QUARTER

VIII. Banking
- A. The savings account
  - 1. Completing a deposit slip
  - 2. The interest formulas
- B. Banking services
  - 1. Checking accounts
  - 2. Borrowing money

IX. Insurance
- A. Life
- B. Disability
- C. Hospital, surgical and medical
- D. Unemployment

X. Investment
- A. Stocks
- B. Bonds
- C. Retirement
  - 1. Social security benefits
  - 2. Private retirement plans
  - 3. Retirement income from annuities

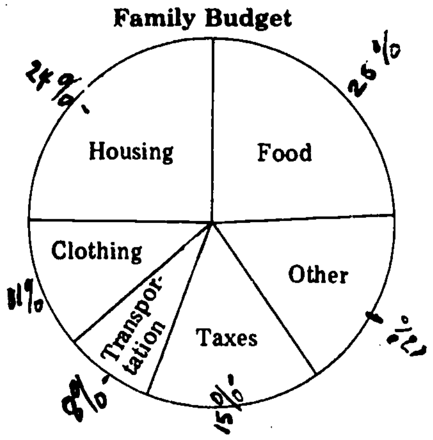
MATHEMATICS OF CONSUMER ECONOMICS
1Q, 2Q, 3Q
MASTERY OBJECTIVES

FIRST QUARTER - OBJECTIVES 1-9

THE STUDENT WILL:

1. Interpret data and statistics to make intelligent decisions based on the use of revelant facts.

   Example: Out of a total family income of $8,000, a family spent its income as depicted on the following circle graph.



   a. The amount of money spent on housing was ______; on clothing _______; on transportation ________; taxes _______; other _______; and food ________.

   b. How do these percentages compare with the percentages of the income spent in the same areas for a family whose income is $30,000?

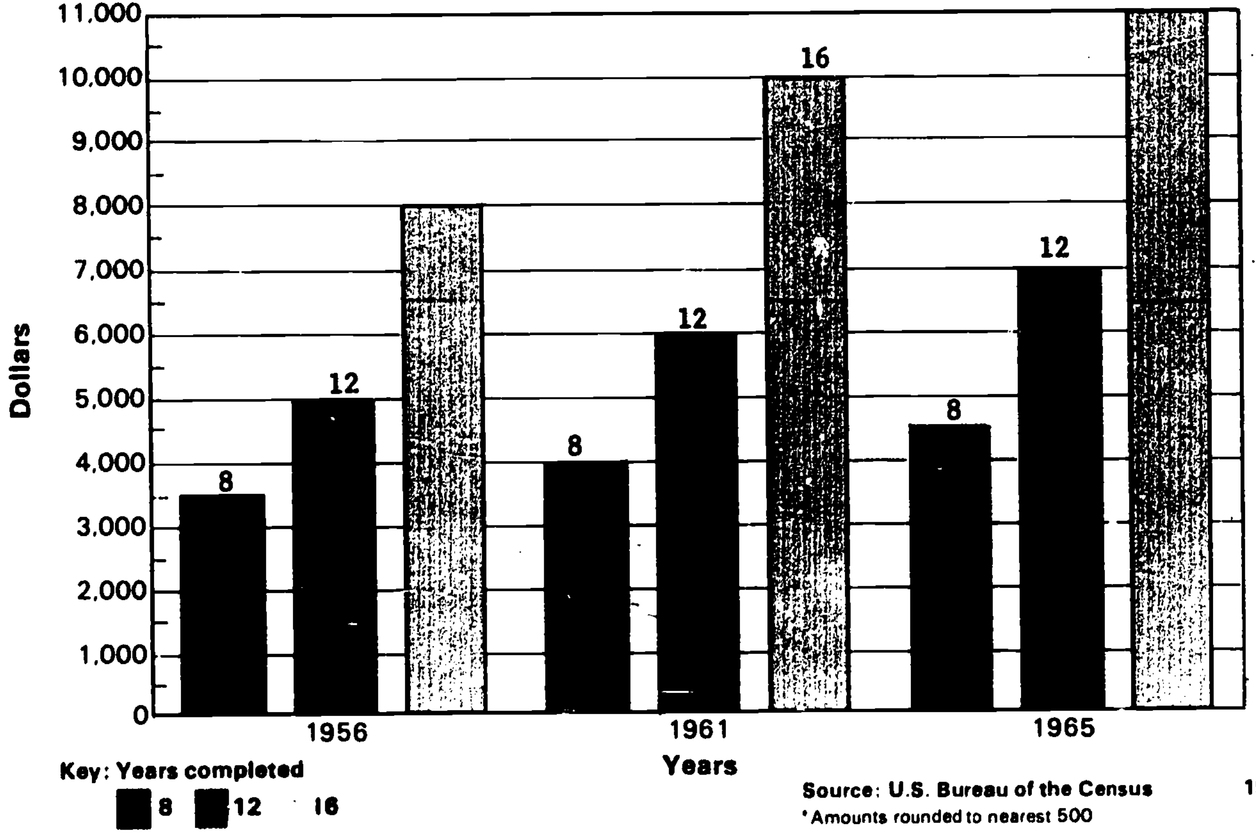
2. Use statistical information to compare particular jobs or professions with the education required for the jobs and the salaries expected from the jobs.

   Example: Refer to the following graph to answer these questions.

MATHEMATICS OF CONSUMER ECONOMICS
1Q, 2Q, 3Q
MASTERY OBJECTIVES

Education and Income

Years of School Completed and Average Yearly Income* for Men Over 25



Source: U.S. Bureau of the Census 1968

*Amounts rounded to nearest 500

a. List five jobs that do not require 12 years of schooling.
b. What is the average income of each?
c. How does each average compare with the chart average for a person that completed 8 years of school in 1968?

3. Determine the costs of purchasing, owning, operating and maintaining a car and responsibilities of this ownership.

<u>Example</u>: You are considering buying a car: a Hornet, Nova, Maverick or Valiant.

a. Choose the special features you want such as air conditioning, radio, power steering, power brakes, etc.
b. Find out the prices of each car with the options you have selected.
c. Find out what a used car, similarly equipped, would cost.

4. Compare the costs of owning and operating a private car to the costs of other means of transportation.

   Example: Determine the costs of riding a bus from your home to work for one month and compare this to the cost of driving a private car to work for one month.

5. Compare the costs of purchasing food from different kinds of stores.

   Example: Given a list of 5 grocery items, determine their prices at 3 different stores.
   a. Find the total cost of the items at each store.
   b. If you could shop at only 2 of the 3 stores, which 2 would you use and what items would you buy at each one?

6. Determine the costs of different methods of obtaining and preparing food for a family.

   Example: a. Given a breakfast menu from a restaurant, make out 3 different breakfast orders and determine the cost of the food, tax (5%), tip (15% of food total) and the total cost of the breakfast orders.
   b. Given a grocery advertisement and a menu from a restaurant, compare the total cost of the same food being prepared at home and eaten out.

7. Use comparative shopping to determine the costs of clothing for an individual and for a family at different kinds of stores and at different times of the year.

   Example: Investigate the price of a 100% polyester ladies pant suit at Neiman Marcus, K-Mart and Sanger Harris department stores. Where did you find the better buy based upon quality of material, appearance, style and cost?

8. Investigate different types of shelter and compare their costs to the cost of owning a house.

   Example: The Smiths now live in a rented apartment and their rent of $225 a month includes heat but no other utilities. How much is this a year? How much will they pay at this rate in 25 years?

9. Find the costs of purchasing, owning, operating and maintaining a house.

Example: The Smiths decided to buy a house priced at $30,000 and find they must make a 20% down payment. How much will the down payment be?

SECOND QUARTER - OBJECTIVES 10-17

10. Determine the different bases for calculating a salary for a particular job or profession and

    a. compute wages based on each method.
    b. identify and calculate the different types of deductions from a worker's pay check.
    c. calculate the "take home pay."

    Example: Compute a 44-hour week's wages for a person who earns $3.10 per hour for the first hours and $4.65 per hour overtime.

11. Determine the benefits which can be received from social security under a given set of conditions as compared to those from private retirement plans.

    Example: Write a brief history of Social Security in the United States.

12. Determine the advantages and disadvantages for the different payroll deductions.

    Example: a. List the advantages and disadvantages of social security as a payroll deduction.
    b. Name other common payroll deductions.

13. Develop an appropriate, realistic and sound budget based on an estimated income.

    Example: Develop a budget for a family of five whose family income is $13,552 per year.

14. Determine, by calculation or from a table, the amount of income tax to be withheld for a given monthly salary.

    Example: Use the tax table for single persons filing on form 1040 to compute the amount of tax for the following incomes:

Total Income	Number of Dependents
1. $2250	1
2. $3715	2
3. $8700	3

15. Determine the amount of income tax an individual will have to pay using a Form 1040 or other tax form, when given a set of conditions.

Example: Joe Jones earned $12,500 in wages last year. His credit union paid a dividend of $150.00 and he received $17.82 and $5.93 in interest from two saving accounts: What is his total income? Compute his income tax if he has 4 dependents using the tax table.

16. Determine the methods for tax assessment in your area and compute the amount of taxes for a given house.

Example: The property tax on the Smith's House is computed as follows. In their community residental property is assessed or valued for tax purposes, at 60% of true market value and the tax rate is $1.50 per $100 of assessed value. How much property tax will they pay each year if the market value remains fixed at $30,000? How much will they pay in 25 years?

17. Determine the advantages and disadvantages of buying on credit and the liabilities involved.

Example: A stereo system that you want to own costs $200. Investigate the possibility of obtaining a loan for this amount for a bank, a finance company, a credit union or through a revolving charge account?

a. Which has the smallest monthly payment?
b. Which takes the shortest length of time to pay off?
c. Which has the lowest total for repayment of the loan?

THIRD QUARTER - OBJECTIVES 18-25

18. Determine the services offered by different banks and ways these services can be used.

Example: Investigate services of mortagage and loan institutes and Federal Banking institutions.

19. Use banking forms such as deposit slips, checks, check book records and bank statements to keep a balanced banking account.

Example: Write a check for $100.52 payable to John E. Smith using the date September 29, 1975. Then fill in the attached check stub.

MATHEMATICS OF CONSUMER ECONOMICS
1Q, 2Q, 3Q
MASTERY OBJECTIVES

No.____$__________

__________, 19__

To __________

Bal. For'd.	215	48
Deposits		
Total		
This Check		
Bal. For'd.		

No. ____ Austin, Texas __________, 19___

MIDPOINT BANK

Pay to the order of ______________ $______

______________________ Dollars

____

20. Use the interest tables to find the amount of interest charged when borrowing from a bank, and compare this interest with other credit costs, such as installment purchases, loans from small loan agencies and loans from credit unions.

    Example: You wish to purchase a car that costs $2995. Compare interest costs of a credit union and a bank for borrowing the amount needed to purchase the car for a 36 month period.

21. Determine medical and dental expenses for a family, when given a set of conditions.

    Example: Assume you broke your leg in an automobile accident and investigate the costs of your medical bill if you were hospitalized for a week.

22. Determine the different types of personal insurance and the advantages for each.

    Example: The Potts have three children ages two, five and seven. Mr. Potts, age 30, feels he should have some additional term insurance for the next few years. Use a rate table from an insurance company to determine his premium.

23. Use the interest tables to find the amount of interest earned on a savings account in a bank; compare this interest with earnings from other savings plans, such as those available from a savings and loan agency and a credit union.

    Example: List 3 ways in which you could invest $500. Name advantages and disadvantages of each.

24. Determine and compare several different ways a person may invest or save money for retirement, recreation and education.

Example: Compare investments in tax sheltered annuity programs with a regular savings account program.

25. Investigate the advantages and disadvantages of investing in stocks and bonds.

Example: Name the major advantages of investing your money in school bonds.

PROBABILITY AND STATISTICS

Purpose: This course is designed to provide a basic introduction to probability and statistics. The extensive use of statistical methods in the modern world makes it essential that the educated citizen understands the fundamental concepts of probability and statistics.

Students who plan careers in the fields of business, economics, education, psychology, sociology, and medicine should include this course in their high school programs.

Description: This course includes a study of:

(1) Analyses of Numerical Data

(2) Probability of Events

(3) Probability Functions

(4) Measures of Central Tendency

(5) Counting Methods

(6) Binomial and Normal Distributions and

(7) Random Variables

PROBABILITY AND STATISTICS
COURSE OUTLINE
(This is a One Quarter course)

I. Organization of Statistical Data

- A. Tables
- B. Graphs
- C. Frequency Tables and Frequency Distributions
- D. Histograms

II. Description of Data

- A. Measures of Central Tendency
- B. Measures of Dispersion
- C. Permutation and combination Formulas

III. Probability

- A. Definition
- B. Union and Intersection of Events
- C. Conditional Probability
- D. Independent Events
- E. Random Samples.

IV. Binomial Distribution

V. Normal Distributions

VI. Inferential Statistics

PROBABILITY AND STATISTICS
MASTERY OBJECTIVES

1. Organize statistical data in tabular or graphic forms by use of frequency distributions.

   Example: The height in inches of students as follows:

64	73	68	59	76
70	62	67	66	69
68	60	65	71	66
68	67	71	68	72

   a) Make frequency table for this data.
   b) Make a cumulative graph of this data.

2. Construct a Histogram and a cumulative Histogram given a set of data.

   Example: Choose a book (your math book will do) and count the number of sentences in a word. Record your results. Do this for 100 sentences. Make a frequency table and a histogram for your data.

3. Given a collection of data, analyze using frequency tabulation, range, mean, median, mode, midpoint of chosen intervals, preparing a histogram and/or a frequency polygon.

   Example:

	Girls	Boys	Class's
Mean height			
Mode height			
Median height			

4. Analyze data by considering measure of dispersion.

   Example: Determine the range, the average, deviation, and the standard deviation for the following set of data:

   $$\{ 20, 70, 3040, 90, 50, 60 \}$$

5. Solve combinatoric problems by use of tree diagrams, analysis or permutation and combination formulas.

   Example: Determine the number of license plates there are in which one letter is followed 6 digits. (assuming any letter and apply digit is possible)

6. Determine a sample space for a probablistic experiment.

   Example: Given a set of five books, two of which are alike, list the sample space when choosing two of the books at a time.

PROBABILITY AND STATISTICS
MASTERY OBJECTIVES

7. Find relative frequencies for the outcomes of a probablistic experiment.

   Example: Place ten coins in a jar, shake the jar and pour the contents on a table. Record the number of heads and the number of tails. Do this 50 times. What are your results?

8. Assign probability values to the outcomes of a probablistic experiment.

   Example: A psychologist had 100 rats trained to run through a maze: 25 were trained to run to the left, 50 to run straight ahead, and 25 to run to the right. Suppose the psychologist reached into the cage containing the rats and selected one at random. When released in the maze, what would be the probability of this rat running?

   a. to the right? b. to the left? c. straight ahead?

9. Find probability values for compound events.

   Example: A girl reaches into her purse and pulls out 2 coins without looking at them or trying to feel their shapes. List an appropriate sample space for this event if she had 5 pennies, 3 nickels, and 3 dimes in her purse. What is the probability of picking out:

   a. 2 pennies? b. a nickel and a penny?
   c. a dime and a nickel? d. at most one dime?
   e. at least one dime? f. a nickel and a quarter?

10. Define and compute probabilities on dependent events, mutually exclusive events, and independent events.

    Example: All the pupils in city high school were taking both Mathematics and English. The probability of a student failing Mathematics is .15, the probability of his failing English is .05, and the probability of his failing both is .04. Are the events of failing English and failing Mathematics independent?

11. Identify mutually exclusive events with respect to set operations.

    Example: Tell whether the events in each part are independent, mutually exclusive, or neither.
    (a) Obtaining a one on each of two rolls of a die.
    (b) Obtaining a 4 and an even number on one roll of die.
    (c) Obtaining an even number and an odd number on one roll of a die.
    (d) Obtaining one odd number and one even number when two dice are rolled.

PROBABILITY AND STATISTICS
MASTERY OBJECTIVES

12. Calculate conditional probability values.

Example: Three bags contain red and black marbles. The first bag contains 4 red and 4 black. The second bag contains 2 red and 6 black. Find P(A / B) if B is the event that a black marble is drawn from one of the bags and A is the event that a black marble came from the first bag.

13. Analyze properties of Binomial coefficient.

Example: a) The value of $\binom{n}{o}$ and $\binom{n}{n}$ are both.

b) Prove: $\binom{n}{r} = \binom{n}{n - r}$

14. Identify a binomial (Guassian) probability experiment.

Example: Explain why it is likely that the experiment described below is not a binomial experiment. Ten of the last 100 parts produced by a machine were defective. What is the probability that this machine will produce fewer than 3 defective parts in the next 20 parts produced.

15. Calculate binomial probability distribution values.

Example: Evaluate each of the following:

b(0; 5, 1/2)   b(7; 10, .2)

16. Use binomial distribution to compute probabilities and solve problems.

Example: 90% of all items produced by company A are satisfactory, while 10% are faulty; Determine the probability of obtaining exactly 4 satisfactory items.

17. Analyze a collection of data by comparing to a normal distribution.

Example: Would you expect the height of 18 year old males to be normally distributed.

18. Define a random variable for a binomial experiment.

Example: Describe an appropriate random variable and its possible values for the experiment of tossing four coins.

PROBABILITY AND STATISTICS
MASTERY OBJECTIVES

19. Solve problems involving a binomial distribution of a random variable.

Example: On each of three slips of paper is a numeral "1," "2," or "3." The slips are to be drawn at random one at a time without replacement. A "match" is obtained if the slip numbered k is selected on the kth draw. Let X be a random variable representing the number of matches obtained. What are the possible values of X?

TRIGONOMETRY

PURPOSE:

This course is designed to prepare the student in a college preparatory program for Analytical Geometry, Elementary Analysis, and Calculus with Analytical Geometry. A knowledge of trigonometry is essential for those who plan careers in Engineering, Physics, Chemistry, Electronics, Radioactivity, Ultrasonics and many other fields. A study of trigonometry may be undertaken for its cultural value as many students take trigonometry for the pleasure they derive from it.

DESCRIPTION:

This course includes a study of:

1. Circular Functions,
2. Relations Among Sides and Angles of Triangles,
3. General angles,
4. Graphs of Circular Functions,
5. Inverses of Circular Functions,
6. Trigonometric Functions, and
7. Identities and Solutions of Equations

Modern trigonometry places less emphasis on solutions of triangles and more on periodic circular functions of real variables and scientific applications. Students are introduced to the Sine and Cosine Functions and these are used to define the remaining circular functions. Major emphasis is placed on proving identities and solving equations and the difference and reduction formulas.

CONTENT OUTLINE

I. The Cosine and Sine Functions

- A. Definition of Periodic Functions
- B. Definition of Sine and Cosine Functions
- C. Special values for sin x and cos x
- D. Addition properties of sine and cosine
- E. Deriving and verifying sine and cosine identities
- F. Basic graphs of sine and cosine

II. The Tangent Function

- A. Definition
- B. Special values for tan x
- C. Basic identities for tan
- D. Graph of tan x

III. The Reciprocal Circular Functions

- A. Cotangent
- B. Secant
- C. Cosecant
- D. Special values of cotx, sec x, and csc x
- E. Basic identities
- F. Graphs of cot x, sec x, and csc x

IV. Identities

V. General graphs of sine and cosine

- A. Amplitude
- B. Period
- C. Vertical shift
- D. Phase shift

VI. Graphing by addition of ordinates

VII. Inverses of Circular Functions

- A. Principal Inverses
- B. Solving Open Sentences
  - 1. General solution
  - 2. particular solution

VIII. Trigonometric Functions

- A. Definition using the right triangle
- B. Angle measure
- C. Trig tables
- D. Solution of right triangles

TRIGONOMETRY 10
MASTERY OBJECTIVES

THE STUDENT WILL:

1. Use a graph or table of values to determine whether a function is periodic and find its fundamental period.

   Example: a function f is shown by the following table

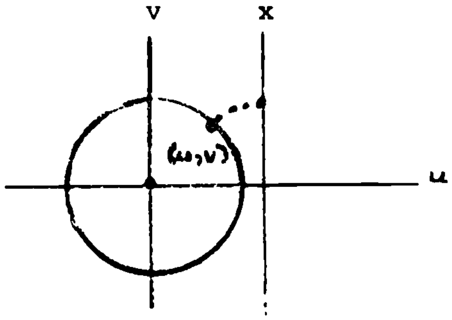
x	0	1	2	3	4	5	6	7	8	9	10
f(x)	3	4	5	6	3	4	5	6	3	4	5

   Is f periodic?
   What is the fundamental period of f?

2. Define the sine and cosine functions as coordinates of a point on the unit circle and state the domain, range and fundamental period of each.

   Example:

   a) cosine $= \{(x,u) \mid u = ?\}$
   domain $= \{x \mid x = ?\}$
   range $= \{u \mid u = ?\}$
   fundamental period = ?



   b) using the periodic functions sine and cosine express the sin p or cos p where $p > 2\pi$ in terms of sin x or cos x where $0 \leq x \leq 2\pi$.

   Example: Express sin $\frac{25\pi}{2}$ as the sin x where $0 \leq x \leq 2\pi$.

3. When x is an integral multiple of $\frac{\pi}{6}$ or $\frac{\pi}{4}$ and $0 \leq x \leq 2\pi$:

   (a) find sin x or cos x when given x.

   Example: If $x = \frac{5\pi}{4}$ find sin x and cos x.
   sin x = ?   cos x = ?

   (b) find x when given sin x or cos x and the quadrant in which x lies.

4. Use $\sin(X_1 \pm X_2)$ and $\cos(X_1 \pm X_2)$ formulas to compute $\sin(X_1 \pm X_2)$ or $\cos(X_1 \pm X_2)$ for specified values of X_1 and X_2.

   Example: If $X_1 = \frac{\pi}{3}$ and $X_2 = \frac{5\pi}{2}$ find $\cos(X_1 - X_2)$.
   $\cos(X_1 - X_2) = \cos\left(\frac{\pi}{3} - \frac{5\pi}{2}\right) = ?$

5. Use $\sin(X_1 \pm X_2)$, $\cos(X_1 \pm X_2)$ formulas and the Pythagorean identity ($\cos^2 X + \sin^2 X = 1$) to: (a) express sine and cosine of $X + 2K\pi$, $\pi - X$, $\pi + X$, $-X$, $2X$, $\frac{X}{2}$, $X \pm \frac{\pi}{2}$ in terms of sin X and/or cos x.

Example: Use $\sin(X_1 - X_2) = \sin X_1 \cos X_2 - \cos X_1 \sin X_2$ to verify $\sin(\pi - x) = \sin X$.

(b) solve equations

Example: Find X where $0 \leq X \leq 2\pi$ and $\cos\frac{\pi}{4} \sin X - \sin\frac{\pi}{4} \cos x = 0$. X = ?

(c) evaluate numerical expressions.

Example: Tet $\cos X_1 = 3/5$, $\cos X_2 = 5/3$ and find $\cos(X_1 - X_2)$ where $0 < X_1 < \pi/2$, $\frac{3\pi}{2} < X_2 < 2$. $\cos(X_1 - X_2) = ?$

(d) verify identities

Example: Verify $\sin X \cos^2 X + \sin^3 X = \sin X$

6. Define the tangent, costangent, secant, and cosecant functions in terms of sine and/or cosine and state the domain, range, and fundamental period of each.

Example: Define tan and state the domain, range, and fundamental period.

$\tan = \{(x, | y) \;\; y = \tan X = ?\}$
domain - $\{| x \;\; x = ?\}$
range = $\{y | \; y = ?\}$
fundamental period = ?

7. When X is an integral multiple of $\frac{\pi}{6}$ or $\pi/4$ and $0 \leq X \leq 2\pi$:

a) find tan x, cot x, sec X, or csc x when given x.

Example: If $x = \frac{5\pi}{3}$ find cot x. $\cot x = \cot\frac{5\pi}{3} = ?$

b) find x when given tan x, cot x, sec x, or csc x and the quadrant in which x lies.

Example: If [illegible] $x = \frac{\sqrt{3}}{3}$ and X lies in quadrant IV, find x. x = ?

8. Use previously proven identities to express tangent of $X + K\pi$, $\pi - X$, $\pi + X$, $-X$, $2X$, $\frac{X}{2}$ in terms of tan X.

Example: verify $\tan(\pi + X) = \tan X$

TRIGONOMETRY 1Q
MASTERY OBJECTIVES

9. Verify identities.

   Example: Verify $\frac{\sec X}{\tan X + \cot X} = \sin X$

10. Graph $g(x) = a.f\ (b\,x + c) + d$ where f is the sine or cosine function and state the fundamental period, amplitude, phase shift, and vertical shift of f as compared to the graph of $y = \sin x$ or $y = \cos X$.

    Example: Give the period, amplitude, phase shift, vertical shift, and graph $\{(x, y) \mid y = 2 \sin (3X + \frac{\pi}{2}) + 3\}$

11. Use addition of ordinates to graph the sum or difference of circular functions.

    Example: Graph $y = \sin X + \cos X$

12. Evaluate expressions involving principal inverses of circular functions when X or a value of f(x) is given.

    Example: Evaluate $\sin (\text{Arcsin } \frac{1}{4} + \text{Arcos } \frac{1}{2})$

13. Use principal inverses of circular functions in solving equations.

    Example: Find X when $\text{Arctan } X = -\sqrt{3}.$ $X = ?$

14. Find general and particular solutions for equations involving circular functions.

    Example: (1) Find X where $0 \leq X < 2\pi$ for $2 \sec^2 X = 2 - 3 \sec X$. $X = ?$

    (2) Find the general solution set of $4 \cos^3 X - \cos X = 0$. $X = ?$

15. Identify the trigonometric functions in terms of the sides of a right triangle and solve right triangles.

    Example: Given $\triangle ABC$ such that $\angle C = 90°$, $\angle A = 28°40'$, $a = 3.71$ find b and c.

16. Solve practical problems using trigonometric functions.

    Example: A guy wire holding a radio-transmitter antenna is 70 feet long and is attached to the antenna at a distance of 50 feet from the ground. Find the degree measure of the angle the wire makes with the ground.

ELEMENTARY ANALYSIS
1Q, 2Q

PURPOSE:

The purposes of this course are to prepare the student in the college preparatory program for a course in Calculus, to reinforce and extend the students' understanding of algebraic concepts and procedures, to provide the student with a better understanding of the structure of mathematics and of the concept of function, and to prepare students for college level mathematics courses.

DESCRIPTION:

This course includes:

1. A review of polynomials
2. An extension and unification of the ideas and skills of algebra, geometry, and trigonometry.
3. A study of mathematical proofs, Induction, Theory of Equations, and partial fractions.
4. A study of matrices and determinants
5. An introduction to the solution of problems using vectors, and
6. An intuitive examination of the concept of limit

As a result of the implementation of the quarter system in Texas, some of the concepts that have traditionally been included in the Trigonometry course are now contained in the Elementary Analysis course. As a result it is recommended that teachers use both of the following books in the Elementary Analysis Course:

1. Modern Trigonometry - Dolciani - pp. 170 - 179, Chapters 6-7
2. Pre-Calculus Mathematics - Shanks - Chapters II, III, IV, IX, XVIII & XX for teaching objectives 8-26

ELEMENTARY ANALYSIS 1Q, 2Q
CONTENT OUTLINE (TENTATIVE)

FIRST QUARTER

I. Solving Oblique Triangles Using Trigonometry

- A. Law of Sines
- B. Law of Sines
- C. Area of Triangle
- D. Ambiguous Case

II. Vectors

- A. Definition & Properties
- B. Operations With Vectors
- C. Applications
- D. Polar Coordinates and Graphs

III. Complex Numbers

- A. Basic Operations With Complex Numbers
- B. Graphs
- C. Polar Representation of Complex Numbers
    - 1. Polar Form For Complex Number
    - 2. Demoivre's Theorem

IV. Functions and Their Graphs

- A. Definition, Properties and Notation
- B. The Algebra of Functions
- C. Composition of Functions
- D. Inverse Functions
- E. Continuity

V. Polynomials

- A. Graphs of Polynomial Functions
- B. Division
- C. Factors and Zeros of Polynomials
- D. The Fundamental Theorem of Algebra
- E. Rational Functions
- F. Algebraic Functions

VI. Exponential and Logarithmic Functions

- A. Properties and Graphs

- B. Equations

ELEMENTARY ANALYSIS 1Q, 2Q
CONTENT OUTLINE (TENTATIVE)

SECOND QUARTER

VII. Functions on the Natural Numbers

A. Arithmetic Sequences and Series
B. Mathematical Induction
C. The Binomial Theorem and Its Extension
D. Limits on Sequences

VIII. Linear Equations, Determinants, Matrices

A. Systems of Linear Equations
B. Properties and Operations With Matrices
C. Matrices and Linear Equations
D. Inverses of Matrices

IX. Conics

A. The Conic Sections
B. Circles, The Parabola, Ellipse, Hyperbola, and Degenerate Conic
C. The General Second-Degree Equation

X. Other Coordinate Systems

A. Translation of Axes
B. Rotation of Axes

XI. Tangents to Curves and Areas Under Curves

A. Slope of a Tangent Line To a Curve
B. Rates
C. Areas
D. Continuity

ELEMENTARY ANALYSIS 1Q, 2Q

TENTATIVE FIRST QUARTER - OBJECTIVES 1-16

THE STUDENT WILL:

1. Use the Law of Sines and the Law of Cosines to solve problems involving oblique triangles.

   Example: In $\triangle ABC$, $a = 63.88M$, $m\angle B = 64°$, and $m\angle C = 59°$ Find Side C.

2. Perform the Basic Operations of Vectors and multiply a vector by a scalar.

   Example: $V_1 = (3, -4)$, $V_2 = (-5, 6)$ and $C = -1$. Find $C\ V1$, $V_1 + V_2$, $V_1 - V_2$

3. Demonstrate ability to write a vector as an ordered pair when its norm and direction angle are known.

   Example: a) $V = (3, -4)$. Find the norm and direction angle of V.

   b) $||V|| = 3$, $\theta = 45°$ Find V.

4. Use vectors to solve applied word problems by choosing the correct resultant vector, given the components.

   Example: A ship steams 45 miles due North, turns to a heading of 45° and steams 25 miles, then turns South and steams 40 miles. How far is it from its starting place?

5. Write a polar coordinate equation equivalent to a cartesian equation and sketch the graph.

   Example: a) Transform the following equation from polar to cartesian coordinates. $P = 3 \cos\theta$

   b) Transform the cartesian equation to polar coordinates. $y + x = 0$.

6. Add, subtract, multiply and divide complex numbers when expressed in standard form, as an ordered pair of real numbers or as polar coordinates.

   Example: Let $Z = (3, -4)$ and $Z_2 = (-3, 4)$
   Find $Z_1 \cdot Z_2$ and $\frac{Z_1}{Z_2}$ And $Z_1 - Z_2$

7. Apply Demoivres' Theorem to find roots and Powers of complex numbers.

   Example: Use Demoiveres' Theorem to find $(-1 + i)^4$ in standard form; and

$$\left(\frac{\sqrt{3}}{2} + 1/2\ i\right)^{\frac{1}{3}}$$

ELEMENTARY ANALYSIS 1Q, 2Q
TENTATIVE FIRST QUARTER - OBJECTIVES 1-16
(cont.)

8. Define, state the range and domain, and sketch the graph of a function and its inverse.

   Example: For $R = \{(u,v): v = u^2\}$
   Sketch a graph of R & R^{-1}
   State the range & domain of R & R^{-1}
   State whether each is a function

9. Perform the algebra of functions and the composition of functions.

   Example: Given $f = \{(x, Y): y = x^2 - 2x + 3\}$ and $g = \{(x, y): y = 3 - 2x^2\}$. Find f + g, f - g, f(g), $\frac{f}{g}$ and fog

10. Determine the nature of the roots and find all rational roots of a polynomial.

    Example: Find all rational zeros of
    $P(x) = 3x^3 + 4x^2 + 8x - 8$

11. State the range and domain and sketch the graph of an exponential or logarithmic function.

    Example: Sketch the graph of $y = 2^x$ and state the range and domain.

12. Solve an exponential equation.

    Example: $4^{x+3} = 16$

13. Expand a series expressed in summation notation

    Example: Expand and simplify. $\sum_{n=1}^{5} (2^{n-1}) = ?$

14. Exhibit an understanding and knowledge of the formulas and principles used in a arithmetic sequence or an arithmetic series.

    Example: Which term of 8, 5, 2, ..., 15 (-28)?

15. Exhibit an understanding and knowledge of the formulas and principles used in a geometric sequence or a geometric series.

    Example: Write the 7th term in the given sequence
    $\frac{3}{64}, -\frac{3}{16}, \frac{3}{4}, -3, \ldots$

16. Demonstrate an understanding of the induction principle by proving by induction for a given proposition.

    Example: Prove: $(a + b)^n = \sum_{b=0}^{n} \frac{n!}{b!\,(n-b)!} \left(a^{n-b}\, b^{b}\right)$
    Where a and b are nonzero real numbers and n is a natural number.

ELEMENTARY ANALYSIS 1Q, 2Q
TENTATIVE SECOND QUARTER - OBJECTIVES 17-23

17. Exhibit ability to expand a binomial with rational exponent.

Example: Write the first 4 terms of the expansion of:
$(a - 2)^{-8}$, $(a - 2)^{1/3}$, $(8 - a)^{-1/3}$

18. Solve a system of linear equations with determinants using Cramer's rule and write the solution set as an ordered triplet.

Example: Solve the system using Cramer's rule.

$$\begin{cases} x + y + z = 10 \\ 2x - 3y - z = -10 \\ 3x + 4y - 2z = 8 \end{cases}$$

19. Demonstrate knowledge of the properties of matrices.

Example: a) Write the additive and multiplicative identity elements for the given matrices.

$$A = \begin{bmatrix} 2 & 4 \\ 3 & 6 \end{bmatrix}, \quad B = \begin{bmatrix} 2 & 3 & 0 \\ 1 & 4 & 2 \\ 3 & 6 & 1 \end{bmatrix}$$

b) Given matrix A, Find A^{-1}

20. Solve a system of equations using a matrix equation.

Example: Solve the system of equations below using a matrix equation.

$$\begin{cases} x + y + z = 10 \\ 2x - 3y - z = -10 \\ 3x + 4y - 2z = 8 \end{cases}$$

21. Translate an algebraic equation of a conic section into its geometric graph.

Example: Find the vertex, focus and equation of the directrix and sketch the graph of the parabola $- y^2 - 4y - 2x - 8 = 0$

22. Identify the type of conic section that a given equation represents.

Example:
$9x^2 + 16y^2 - 18x - 64y = 71$
$9x^2 - 16y^2 - 18x - 64y = 19$
$x^2 - 4x - 2y = 0$
$x^2 + y^2 + x - 4y - \frac{1}{4} = 0$

23. Write the equation of a conic section given a sufficient set of conditions about the geometric graph.

Example: Write the equation of a Hyperbola with transverse axis 8 inches long and foci at (-2, 2) and (8, 2).

ELEMENTARY ANALYSIS 1Q, 2Q
MASTERY OBJECTIVES FOR HONORS ONLY 24-26

24. Find the slope of the tangent line at an arbitrary point on the graph of function.

    Example: If $f(x) = x - x^2$, what is the slope of the tangent line through $(\frac{1}{2}, \frac{1}{4})$?

25. Demonstrate a knowledge of continuity.

    Example: Show that the function $f(x) = x^2$ for all real x is continuous at $x = 2$.

26. Find the area under the graph of a function between two given values in its domain.

    Example: If $f(x) = x^2$, find the area under the graph of f between 0 and 1.

ANALYTIC GEOMETRY 1Q, 2Q
MASTERY OBJECTIVES

PURPOSE:

The purpose of the course is three-fold: it reviews concepts developed in previous courses (algebra, trigonometry and analysis), it provides the student with a thorough understanding of analytic geometry in two- and three-spaces which is approached from a vector standpoint and the course provides a solid base for the study of calculus in the future.

DESCRIPTION:

In this course the student will be:

1. Reviewing concept studied in previous courses.
2. Studying the fundamental concepts for working in two-space (midpoint formula, distance formula, etc.)
3. Graphing equations in the Cartesian and polar coordinate systems.
4. Writing the equations of a graph, given a description of the graph.
5. Studying special techniques for graphing such as investigating domain, asymptoter and symmetry.
6. Learning about operations with vectors. (This is a preview for our work in three-space).
7. Writing the equations of lines and planes in three-space.
8. Studying the equations of other curves and surfaces in three-space.

ANALYTIC GEOMETRY 1Q, 2Q
MASTERY OBJECTIVES

Content Outline

FIRST QUARTER

I. Reviewing Concepts from Previous Courses
   This is a unit to last from 3 to 5 weeks. During this time, the teacher can assess the needs of the students, review important topics from the previous course, etc. This unit would vary greatly from year to year.

II. Fundamental Concepts of Analytic Geometry (Chapter 1 - Analytic Geometry by Gordon Fuller *)

III. The Straight Line and Circle (Chapter 2 *)

IV. Conics (Chapter 3 *)

V. Polar Coordinates (Chapter 5 *)

SECOND QUARTER

VI. Parametric Equations (Chapter 6 *)

VII. Algebraic Curves (Chapter 7 *)

VIII. Vector Foundation for Three-space Analytic Geometry (Chapter 9 *)

IX. Lines and Planes in Three-space (Chapter 9 *)

X. Other Curves and Surfaces in Three-space (Chapter 8 *)

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* All chapter references are made to the textbook referred to in FIRST QUARTER - II.

ANALYTIC GEOMETRY 1Q, 2Q
MASTERY OBJECTIVES

FIRST QUARTER - OBJECTIVES 1-23

THE STUDENT WILL:

1. Use the following definitions: absolute value, cartesian coordinate system, abscissa, ordinate, slope, median, relation, function.

   Example: Given (-3, 2), what is the absolute value of the abscissa?

2. Apply the distance, midpoint and slope formulas.

   Example: Given a triangle A (3,2), B(-5,1), C (7,8), find the slope of the median from A to $\overline{BC}$. Also find its length.

3. Prove analytically certain geometric theorems.

   Example: Prove analytically that the diagonals of a rectangle have the same length.

4. Graph simple equations by plotting points.

   Example: Graph $x = y^2 - 4$

5. Write the equation of a graph, given a description of this graph.

   Example: Find the equation of the set of points P(x,y) which are equidistant from (2, -4) and (-1, 5).

6. Write the equation of a line given the slope and one point (or two points) and write the answer in any of the following forms: $y - y_1 = m(x - x_1)$, $y = mx + b$, $Ax + By + C = 0$, or $\frac{x}{a} + \frac{y}{b} = 1$.

   Example: Line 1 passes through A (3, -1), B (-4,5). Write its equation in the $y = mx + b$ form.

7. State and use the formula for the distance from a point to a line. (undirected distance).

   Example: Find the distance from (2, -1) to the line $12x + 5y + 12 = 0$.

8. Write equations for families of lines which have a given property.

   Example: Write an equation for a family of lines parallel to $y = 3x + 2$.

9. Graph circles, given the equation in the form $x^2 + y^2 = r^2$, $(x-h)^2 + (y-k)^2 = r^2$ or $x^2 + y^2 + Dx + Ey + F = 0$.

Example: Graph $x^2 + y^2 - 6x + 4y - 12 = 0$

10. Write the equation of a circle given certain information about it.

    Example: A circle is tangent to the line $2x - y + 1 = 0$ at the point (2,5) and the center is on $x + y = 9$. Write the equation.

11. Write the general equation for a family of circles passing through the intersection of two circles and determine a specific member of the family.

    Example: Write the equation of a circle through the intersection of the two circles given below and also passing through the point (7,0).

    C_1: $x^2 + y^2 - 6x + 2y + 5 = 0$

    C_2: $x^2 + y^2 - 12x - 2y + 29 = 0$

12. Simplify an equation of the form $x^2 + y^2 + Cx + Dy + F = 0$ by a translation of the axes.

    Example: Rewrite the equation of the circle $x^2 + y2 - 6x + 4y - 3 = 0$ relative to a new set of axes x', y'. In the process, eliminate the linear terms. Find the point to which the origin must be moved in order to accomplish this.

13. Graph equations of the form $y^2 = 4ax$ or $x^2 = 4ay$.

    Example: Sketch $y^2 = 8x$

14. Write the equation of a parabola (vertex at the origin), given certain information about it.

    Example: Write the equation of a parabola, vertex at (0,0), given that it opens to the right and the latus rectum is 6.

15. Sketch equations of the form $x^2 + Dx + Ey + F = 0$ or $y^2 + Dx + Ey + F = 0$, by first rewriting them in the form $(x - h)^2 = 4a(y - k)$ or $(y - k)^2 = 4a(x - h)$, then translating the axes to obtain equations $x'^2 = 4ay'$ or $y'^2 = 4ax'$.

    Example: Sketch $y^2 + 8x - 6y + 25 = 0$.

16. Sketch the graph of ellipses given in any of the following forms:

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1, \quad \frac{(x - h)^2}{a^2} + \frac{(y - k)^2}{b^2} = 1,$$

$Ax^2 + By^2 + Cx + Dy + F = 0.$

Example: Graph $16x^2 + 25y^2 - 160x - 200y + 400 = 0$

17. Write the equation of an ellipse given certain data about it.

Example: Write the equation of an ellipse with a focus at (2,3), vertex at (2,6) and minor axis of length 6.

18. Sketch, showing the asymptotes, the graph of hyperbolas given in any of the following forms:

$\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1, \qquad \frac{(x - b)^2}{a^2} - \frac{(y - k)^2}{b^2} = 1,$

$Ax^2 + By^2 + Cx + Dy + F = 0.$

Example: Sketch $y^2 - x^2 = 1$.

19. Plot points in the polar coordinate system.

Example: Plot $P(-3, 180^\circ)$.

20. Change rectangular coordinates to polar coordinates and conversely.

Example: Find the rectangular coordinates for $P(3\sqrt{2}, 45^\circ)$.

21. Transform equations in rectangular coordinates to polar coordinates and conversely.

Example: Find the polar form for the equation $x^2 + y^2 = 25$.

22. With the aid of symmetry rules, graph equations in polar coordinates.

Example: Graph $r = 4 \cos \theta$.

23. Identify, by inspection of the polar equation, the following curves: circles, lines, cardiods, limacons.

Example: Name the curve represented by the equation $r = 3 + 3 \sin \theta$.

SECOND QUARTER - OBJECTIVES 24-39

24a. Graph equations given in parametric form.

Example: $\begin{cases} x = 2 + t \\ y = 3 - t^2 \end{cases}$

24b. Convert equations given in parametric form to equations in rectangular form.

Example: Eliminate the parameter to get a rectangular equation for

$$\begin{cases} x = 1 + t \\ y = 4 - 3t \end{cases}$$

25. Apply the techniques of stating the domain, testing for symmetry and locating asymptotes and intercepts to graph certain types of equations.

Example: a. Graph $y = \sqrt{25 - x^2}$.

b. Graph $y = \frac{1}{1 - x^2}$.

c. Graph $xy - x - 3 = 0$.

26. Solve systems of equations of the following forms:

$$\begin{cases} Ax + By = C \\ Dx + Ey = F \end{cases}, \qquad \begin{cases} Ax^2 + By^2 = C \\ Dx + Ey = F \end{cases}$$

$$\begin{cases} Ax^2 + By^2 = C \\ Dx^2 + Ey^2 = F \end{cases}, \qquad \begin{cases} Ax + By^2 = C \\ Dx + Ey = F \end{cases}$$

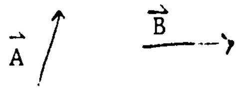
Example: Solve $\begin{cases} x^2 + 4y^2 = 25 \\ 4x^2 - 7y^2 = 8 \end{cases}$

27. Plot points and graph simple equations.

Example: a. Plot (2,3,5), in three-space.
b. Graph $x = 3$.

28. Perform the operations of addition, scalar multiplication on free vectors.

Example:

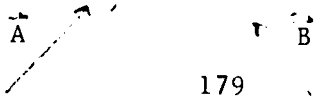


Find $\vec{A} + \vec{B}$

29. Demonstrate knowledge of the following theorems on the two vector operations of addition and scalar multiplication.

1. $\vec{A} + \vec{B} = \vec{B} + \vec{A}$
2. $\vec{A} - \vec{B} = \vec{A} + (-\vec{B})$
3. $(m + n)\vec{A} = m\vec{A} + n\vec{A}$
4. $m(\vec{A} + \vec{B}) = m\vec{A} + m\vec{B}$

Example: Show by diagram that $3(\vec{A} + \vec{B}) = 3\vec{A} + 3\vec{B}$, given the vector shown:



30. Perform the following operations on vector in the coordinate plane (or in space):

    a. Normalize a vector expressed in $\vec{i}$, $\vec{j}$, $\vec{k}$ notation.

    Example: Normalize the vector
    $V = 2i + 3j$

    b. Express a vector anywhere in the plane (or in space) in $\vec{i}$, $\vec{j}$, $\vec{k}$ notation.

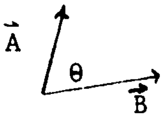
    Example: Find PQ in $\vec{i}$, $\vec{j}$ notation given that P is (2,3) and Q is (-4,5).

31. Use vectors to find the trisection points of a segment in two-space and three-space.

    Example: Find the points that trisect the segment $\overline{AB}$, given that A is (1,3) and B is (4, -3).

32. Find the angle between two vectors using the formula $\cos \theta = \frac{\vec{A} \cdot \vec{B}}{|\vec{A}| \cdot |\vec{B}|}$. (NOTE: $\vec{A} \cdot \vec{B}$ is called the "dot product.")

    Example:



    $\vec{A} = 6i - 3j + 2k$

    $\vec{B} = -2i + j + 2k$

    Find θ, the angle between the vectors.

33. Write the equation of a plane, given certain information about the plane.

    Example: Write the equation of the plane perpendicular to the segment joining (4,0,6) and (0,-8,2) and passing through the segment's midpoint.

34. Find the angle between pairs of planes.

    Example: Find the angle between the following planes.

    $$2x + y + z + 3 = 0$$
    $$2x - 2y + z - 7 = 0$$

35. Write the equations of a line in vector form, parametric form and symmetric form.

    Example: Find the symmetric equations of a line passing through P(1,2,3) and Q(-2,4,0).

36. Be able to find the "cross product" of two vectors and use it to find the area of a triangle or parallelogram in space.

Example: Find the area of a triangle determined by A(3,0,3), B(1,7,8), C(2,4,1).

37. Using the appropriate formula, find the distance from a point to a line or from a point to a plane.

Example: Find the distance from (0,3,5) to the plane $3x + 2y + 7z + 5 = 0$.

38. Graph planes, cylinders and spheres in three-space given the equation.

Example: Graph $2x + 3y + 7z = 14$.

39. Identify, by looking at the equation, the following surfaces: the ellipsoid, the hyperboloid and the paraboloid.

Example: Name the graph of

$$\frac{x^2}{4} + \frac{y^2}{16} + \frac{z^2}{4} = 1.$$

CALCULUS 1Q, 2Q, 3Q

PURPOSE:

The purpose of this course is to develop a language for expressing physical laws in precise mathematical terms and as a tool for studying the applications of these laws. The course will prepare the college-bound student in the fields of mathematics, science and engineering.

DESCRIPTION:

This course includes a study of the following:

1. Review of concepts of functions.
2. Limits.
3. Derivatives of functions.
4. Applications of derivatives.
5. Solution of differential equations.
6. Integrals.
7. Applications of definite integrals.
8. Review of trigonometric identities.
9. Derivatives of trigonometric functions:

   $$\lim_{\theta \to 0} \frac{\sin\theta}{\theta} = 1$$

10. Integrals of trigonometric functions.
11. Integration by parts.
12. Derivatives and integrals of inverse trigonometric functions.
13. Review of laws of logarithms.
14. $\frac{d(\ln x)}{dx}$
15. $\int_a^b \frac{du}{u}$
16. $\int_a^b a^u \, du$; $\int_a^b e^u \, du$
17. Integration by substitution: algebraic, trigonometric.
18. Integration by partial fractions.

CALCULUS 1Q, 2Q, 3Q

Content Outline

FIRST QUARTER

- I. Review of Concepts of Functions
  - A. Definition: domain and range
  - B. Linear functions (slope, intercepts, equation of a line, methods of combining)
  - C. Inverse functions
  - D. Quadratic functions
  - E. Polynomial functions of degree greater than 2

- II. Limits
  - A. Geometric interpretation of concept of limits
  - B. Basic definition of a limit of a function
  - C. Absolute value, intervals and neighborhoods
  - D. Finding $\lim_{x \to a} f(x)$ by using various theorems and properties
  - E. Continuity: definition of $\lim_{x \to a} f(x)$ and f(x) is continuous at a.
  - F. Take $\lim_{\Delta x \to 0} \frac{f(x + \Delta x) - f(x)}{\Delta x}$ is equal to f'(x) which is the derivative of f(x), which is the slope of the curve at x.

- III. Derivatives of Functions
  - A. Use the definition to find the derivative of simple algebraic functions
  - B. Derive the formula for f'(x) of $f(x) = ax + b$, $f(x) = x^n$, $f(x) = h(x)g(x)$, $f(x) = \frac{h(x)}{g(x)}$, and $f(x) = u^n$ (by use of the chain rule)
  - C. Find derivative of parametric equations
  - D. Find derivative of inverse functions
  - E. Define continuity as related to derivatives

- IV. Applications of Derivatives
  - A. Slope of a curve at a point and equation of tangent
  - B. Curve sketching by using f'(x)
  - C. Use second derivative to find maxima, minima and points of inflection
  - D. Use first and second derivatives for curve sketching and determining concavity
  - E. Rolle's Theorem and Mean Value Theorem
  - F. Related Rates: velocity, acceleration, distance, areas and volumes

SECOND QUARTER

- V. Solution of Differential Equations

VI. Integrals
- A. Indefinite: finding/not finding constant
- B. Definite: area under a curve
  - 1. By inner and outer rectangles
  - 2. By use of trapezoid: Simpson's Rule
  - 3. By use of summarization symbols to take the limit
  - 4. By using $\lim_{\Delta x \to 0} \sum_{j=0}^{n} f(x_j) \Delta x$ where $\Delta x = \frac{b - a}{n}$
  - 5. By using $\lim_{\Delta x \to 0} \sum_{j=0}^{n} f(x_j) \Delta x = \int_a^b f(x)dx$, where $\Delta x = \frac{b - a}{n}$
- C. State Fundamental Theorem of Integral Calculus, which says $\int_a^b f(x)dx$ is the exact area under a curve
- D. Take definite integrals, using theorems

VII. Applications of Definite Integrals
- A. Area under a curve
- B. Area between two curves
- C. Length of an arc
- D. Volumes of solid of revolution: disc, shell, washer methods
- E. Surface area of a solid of revolution
- F. Work
- G. Pressure
- H. Center of mass and moments
- I. Average value of a function
- J. Related rates: velocity, acceleration, distance

THIRD QUARTER

VIII. Brief Review of Trigonometric Identities

IX. Derive Formulas for the Derivatives of Trigonometric Functions; $\lim_{\theta \to 0} \frac{\sin\theta}{\theta} = 1$

X Find Derivatives and Integrals of Trigonometric Functions

XI. Integrate by Parts

XII. Find Derivatives and Integrals of Inverse Trigonometric Functions

XIII. Brief Review of Laws of Logarithms
- A. Definition: $\int^x 1/x \, dx = \ln x$
- B. Graph ln x

XIV. Find $\frac{d(\ln x)}{dx}$

XV. Find $\int_a^b \frac{du}{u}$

XVI. Find Derivative and Integral of:
$\int_a^b a^u \, du$; $\int_a^b e^u \, du$

XVII. Integrate by Substitution: Algebraic, Trigonometric

XVIII. Integrate by Partial Fractions

CALCULUS 1Q, 2Q, 3Q
MASTERY OBJECTIVES

FIRST QUARTER - OBJECTIVES 1-19

THE STUDENT WILL:

1. Find the domain and range of a function.

   Example. $f(x) = \frac{x - 2}{x - 3}$

   $x = \frac{3f(x) - 2}{f(x) - 1}$

   D: $\{x | x \neq 3; R\}$
   R: $\{f(x) | f(x) \neq 1; R\}$

2. Find the equation of a linear function, given: point, slope, two points; point, parallel to a line; point, perpendicular to a line.

   Example: Find the equation of a line passing through (-4, 3) and parallel to the line $3x + 4y = 12$.

3. Combine functions.

   Example: $f(x) = 3x^2 - 2x$
   $g(x) = \frac{1}{4x - 2}$
   Find $f[g(x)]$.

4. Graph a function and its inverse on the same set of axes.

   Example: $f(x) = x^2 + x + 1$
   $x = y^2 + y + 1$
   $y = \frac{-1 \pm \sqrt{4x - 3}}{2}$

5. Find the zeros and graph polynomial function.

   Example: Find the zeros and graph the function

   $f(x) = x^4 + 2x^3 - 13x^2 - 14x + 24$.

6. Find the limit on the following function by geometric interpretation.

   Example: $\lim_{x \to \infty} f(x) = \frac{10}{x}$

7. Prove the following limits by using the definition.

   Example: $\lim_{x \to 2} 4x - 2 = 6$

8. Use absolute value and inequalities to describe intervals and neighborhoods.

   Example: Describe the deleted neighborhood of $0 < |x - 2| < 4$.

CALCULUS 1Q, 2Q, 3Q
MASTERY OBJECTIVES

9. Find the limit of functions.

Example: Find $\lim_{x \to -4} \frac{x^2 - x - 20}{x + 4}$.

10. Use the definition of a continuous function to determine if it is continuous.

Example: a. Investigate the continuity of $f(x) = x^2$ at some fixed value $x = c$.

b. For what values of x is the following function continuous?

$$f(x) = \frac{x}{x - 1}$$

11. Find the derivative and slope at a point of any function.

Example: Find $f'(x)$ for $f(x) = x^2 + 2x - 3$ and find the slope at the point (2, 5).

12. Derive $f'(x)$, given $f(x) = ax + b$, $f(x) = x^n$

$f(x) = h(x)g(x)$, $f(x) = \frac{h(x)}{g(x)}$, and $f(x) = u^n$

Example: a. Find $f'(x)$: $f(x) = \frac{x^2 - 3x}{x^2 + 4}$

b. Find $f'(x)$: $y = u^2 + 3$, $u = 2x + 1$

13. Find the derivative of parametric equations.

Example: Find $f'(x)$, given $x = t + \frac{1}{t}$, $y = t + 1$

14. Determine the inverse of a function and find its derivative.

Example: Solve for the derivative of the inverse of $f(x) = \frac{2x + 5}{x - 2}$.

15. Find the equation of a tangent to a given curve at a given point.

Example: Find the equation of the tangent to the curve $f(x) = x^3 - 2x^2 + 4$ at (2, 4).

16. Sketch the curve using the first and second derivatives.

Example: a. Determine the maxima/minima, points of inflection and concavity of $f(x) = 3x^4 - 10x^3 - 12x^2 + 12x - 7$.

b. A rectangular field to contain a given area is to be fenced off along a river. If no fencing is needed along the river, show that the least amount of fencing will be required when the length of the field is twice its width.

17. Use Rolle's Theorem.

Example: Does Rolle's Theorem apply to $f(x) = \frac{x^2 - 4x}{x - 2}$? Prove your decision.

18. Use the Law of the Mean (Mean Value Theorem).

Example: Find the value of x_0 prescribed by the Law of the Mean, given $f(x) = 3x^2 + 4x - 3$, $a = 1$, $b = 3$.

19. Find related rates.

Example: A body moves along a straight line according to the law $s = (1/2)t^3 - 2t$. Determine its velocity and acceleration at the end of 2 seconds.

SECOND QUARTER - OBJECTIVES 20-32

20. Find differential of equations.

Example: Find dy: $x^3 - 3xy + y^3 = 1$

21. Take an integral of the type: $\int x^n\,dx$; $\int u^n\,du$.

Example: Find the curve whose slope at the point (x, y) is $3x^2$ if the curve is also required to pass through the point (1, -1).

22. Develop integrals by finding the area under a curve.

Example: Calculate the area swept out by an ordinate segment as one end moves along the line $y = x$ as follows: from (1, 1) to (5, 5).

23. Use the Fundamental Theorem of Integral Calculus to find the exact area under a curve.

Example: $\int_a^b x\sqrt{1 - x^2}\,dx$ from $x = 0$ to $x = 1$

24. Find area under a curve or between two curves.

Example: Determine the total area enclosed between the curve $y = x^3 - 4x$ and the straight line $y = 5x$.

25. Determine the length of an arc.

Example: Find the length of the curve $y = x^{\frac{3}{2}}$ between (0, 0) and (9, 27).

26. Find the volume of solid of revolution.

<u>Example</u>: Find the volume generated by revolving the given plane area about the given line:
$y = x^2 - 5x = 6$, $y = 0$; y - axis

27. Find the lateral area of a solid of revolution.

<u>Example</u>: The arc of $3y^2 = x(x - 1)^2$ between (1, 0) and (3, 2) is rotated about the x-axis. Find the area of the surface generated.

28. Determine the work done by a force.

<u>Example</u>: A force of 80 lb. stretches a 12 ft. spring 1 foot. Find the work done in stretching it from 12 to 15 feet.

29. Solve for the pressure exerted on the surface (per unit of area) of an object.

<u>Example</u>: A circular valve in a water main has a one-foot radius. Find the total force (pressure) on the valve if its center is 40 feet below the surface of the water.

30. Find the centroid (center of mass and moments).

<u>Example</u>: Find the centroid of the region cut out of the first quadrant by $x = 3 - 2y - y^2$.

31. Determine the average (mean) value of a function on a given interval.

<u>Example</u>: Find the mean (average) value of y with respect to x on the arc of $y = x^3 = 9x$ that has endpoints (0, 0) and (3, 0).

32. Find the related rate involving distance, velocity and acceleration.

<u>Example</u>: $a = \sqrt{4t + 1}$, $V_c = -4\ 1/3$
The function a = f(t) represents the acceleration (ft/sec^2) of a moving body and V_c is its velocity at time, t = 0. Find the distance traveled by the body between time t = 0 and t = 2.

THIRD QUARTER - OBJECTIVES 33-44

33. Derive the formulas for finding the derivatives of trigonometric functions.

<u>Example</u>: Find $\frac{dy}{dx}$: $y = \sin x$

CALCULUS 1Q, 2Q, 3Q
MASTERY OBJECTIVES

34. Find the derivatives of trigonometric functions.

Example: If $y = 2$ si [illegible] $+ 5$ cox $6x$, find $\frac{dy}{dx}$.

35. Find integrals of trigonometric functions.

Example: $\int \tan^2 x \sec^4 x \, dx$

36. Integrate by parts.

Example: Find $\int x \cos x \, dx$.

37. Find derivatives of inverse trigonometric functions.

Example: Find $\frac{dy}{dx}$ where $y = \text{arc} \cos 6x$.

38. Find integrals of inverse trigonometric functions.

Example: Find $\int \text{arccos } 2x \, dx$.

39. Find $\frac{d(\ln x)}{dx}$.

Example: Find $\frac{dy}{dx}$ where
a. $y = 3e^{2x + 1}$
b. $y = \ln \frac{x^2 - 2}{x + 1}$
c. $y = \frac{e^x + e^{-x}}{e^x - e^{-x}}$

40. Find $\int_a^b \frac{du}{u}$.

Example: Find $\int_0^2 \frac{3x \, dx}{x^2 + 2}$.

41. Find $d(a^u)du$; $d(e^u)du$.

Example: Find $\frac{dy}{dx}$ where $y = 10^x \, dx$.

42. Find $\int a^u \, du$; $\int e^u \, du$.

Example:
a. Find $\int x^2 e^x dx$.
b. Find $\int \frac{10^{\ln x}}{x} \, dx$.

43. Integrate by substitution.

Example: Find $\int \sqrt{x^2 - 4} \, dx$; $\int x \sqrt{x - 3} \, dx$.

44. Find integrals by partial fractions.

Example: Find $\int \frac{dx}{x^2 - 9}$.

INDEPENDENT STUDY COURSES

History of Mathematics, Survey of Mathematics, Number Theory, Linear Algebra and Linear Programming are the independent study courses offered in the Dallas Independent School District. It is not expected that classes be scheduled to meet for any of these courses. Individual students are to be assigned teacher advisors and depending upon the interests, background and aspirations of the student, select an appropriate independent study course. A regular schedule should then be developed and goals and objectives delineated. The following pages contain suggested mastery objectives for each course.

HISTORY OF MATHEMATICS
IQ
MASTERY OBJECTIVES

1. Demonstrate a knowledge of at least two ancient numeration systems by:
    a. representing large numbers in the system.
    b. writing fractions in the system or stating that fractions were not used.
    c. stating the approximate dates and place the numeration system was used.
    d. stating at least two practical applications of mathematics at the time and place the system was used.
    e. computing in the system and giving advantages and disadvantages of the system as compared to Hindu-Arabic.

2. Count in a place-value system other than 10; make addition and multiplication matrices in the system; use the matrices in computation; state advantages and disadvantages of this base compared with 10.

3. State the origin of the symbol for zero and the recognition of zero as a number.

4. Classify numbers as prime or composite and give the names, homes, and approximate lifetimes of three men who have worked on finding primes.

5. Represent rational numbers in fractional and decimal form; demonstrate those operations which are easier in each form.

6. Identify the era, the place, and the people responsible for the first proof of the Pythagorean Theorem; give the name of at least one other person who has proved the theorem in a unique way; use the theorem in practical problems.

7. Use a formula to write a Pythagorean triple and prove that it is one.

HISTORY OF MATHEMATICS
1Q
MASTERY OBJECTIVES

8. Identify an irrational number in a set of numbers; determine the era in which they were used and the group of people who discovered them.

9. Identify an imaginary number when written as an even root of a negative number; state at least one application of complex numbers; find the name of a mathematican who was responsible for their development.

10. Identify and represent numbers on an abacus and perform calculations using an abacus.

11. Demonstrate knowledge of an algorithm by explaining each step in one, such as the algorithm for making a hamburger, dialing a phone, etc.

12. Trace the development of calculating devices from Pascal to modern computers.

13. Distinguish between analog and digital computers and give an example of each.

14. Write a paragraph on the skills and shortcomings of at least two "calculating prodigies."

15. Write a paragraph on the rise and fall of logarithms as tools for calculating.

16. Write a paper on the applications of practical geometry in an ancient civilization such as Egypt, Babylon, Judah, or China.

17. Compare Greek geometry to the other ancient geometries as to purpose and application.

HISTORY OF MATHEMATICS
1Q
MASTERY OBJECTIVES

18. Give the names and contributions of at least three people involved in the search for the proof of Euclid's Fifth (Parallel) Postulate and the development of the non-Euclidean geometries.

19. Identify a golden rectangle and name at least one application in art, in architecture, and in nature.

20. Use the basic construction techniques to construct and solve more difficult construction problems.

21. Give a reason for the dependence of the Greeks on construction techniques on the solution of problems.

22. Identify the three famous unsolvable construction problems from antiquity and investigate the legends concerning the origins of these problems.

23. Identify the five regular polyhedrons, construct models of them, find the names of several mathematicians who studied them and the significance of their study.

24. Demonstrate the way a cone must be cut to produce each of the conic sections and find the names of several mathematicians who studied them and the significance of their study.

25. Contrast five algebraic symbols with other symbols meaning the same thing and find the era and locality in which they were used.

26. Write a paragraph on the algebra used by three ancient civilizations.

MASTERY OBJECTIVES

27. Find the contribution that Diophantus of Alexandria made to algebra.

28. Find the names of several people who contributed to the solution of general polynomial equations of the third, fourth, and fifth degrees; tell when and where they lived.

29. Find the names of five nineteenth or twentieth century mathematicians; give their contributions to mathematics and the time and place in which they lived.

SURVEY OF MATHEMATICS
1Q
MASTERY OBJECTIVES

The student will be able to:

1. Use the concepts of sets to show relations, equivalence relations, and comparisons of finite and infinite sets.

2. Translate a verbal statement into symbolic notation and construct a truth table for the statement to determine if the conclusion is valid.

3. Use the algebra of binary variables to solve logic problems.

4. Use the ancient and modern numeration systems, including nonplace value, base 10 and bases other than 10 to determine the advantages and disadvantages of each system.

5. Identify and show the relationship between subsets of the complex number system and identify the properties of each system.

6. Use patterns to establish conclusions.

7. Use Pascal's triangle to predict the chance of getting a certain result.

8. Determine the probability of an event and use the probability to determine the odds.

9. Collect and arrange statistical data to determine the measures of central tendency.

10. Use statistical information to construct and interpret a normal distribution curve.

SURVEY OF MATHEMATICS
1Q
MASTERY OBJECTIVES

11. Explore finite number and abstract systems in mathematics and their operations.

12. Use the properties of a mathematical system to determine whether the system is a group, a field, or neither.

13. Use the trigonometric ratios to solve practical problems involving right triangles.

14. Use the laws of sines and cosines to solve practical problems involving oblique triangles.

NUMBER THEORY

1Q

MASTERY OBJECTIVES

1. Use the principle of mathematical induction for proofs of statements about sums and products of Fibonacci numbers.

2. Use the Sieve of Eratosthenes to find the prime numbers between a pair of given integers.

3. Find the canonical representation of a given integer.

4. Use the Euclidean algorithm to find the greatest common divisor of two given integers.

5. Use the Fundamental Theorem of Arithmetic to find the least common multiple 1f two given integers.

6. Use the formulas to find the sum and number of divisors of a given integer.

7. Find the greatest common divisor of two given integers and express it as a linear homogeneous function of those integers.

8. Determine whether a given number is a perfect number.

9. Use the solution to the Pythagorean equation to generate a specified set of primitive Pythagorean triples.

10. Prove that there are infinitely many primes.

11. Generate the first four Mersenne numbers and verify that they are prime.

NUMBER THEORY

1Q

MASTERY OBJECTIVES

12. Find the Euler function ϕ (n) of a given integer.

13. Use definitions, assumptions, and previously proved theorems to prove statements involving divisibility properties.

14. Construct addition and multiplication tables for a given modulo system and check the field properties.

15. Find a complete residue system for a given modulus and express it as multiples of a given integer.

16. Determine the reduced residue system or primitive roots for a given modulus.

17. Use Euler's Theorem to find a solution of a given linear congruence.

18. Use linear congruences to determine the general solution of a given linear Diopantine equation.

19. Prove and use the converse of Wilson's Theorem to determine whether a given integer is a prime.

20. Solve a given system of linear congruencies using the Chinese Remainder Theorem.

21. Determine whether a given quadratic congruence has a solution.

LINEAR ALGEBRA
1Q
MASTERY OBJECTIVES

1. Prove basic properties of all operations involving vectors and/or scalars.

2. Determine whether a given set of vectors is a subspace of a vector space.

3. Determine whether a given set of vectors is linearly independent, and, if not, reduce this to an independent set.

4. Determine the dimension of a vector space; and then find normal orthogonal basis for this space and the coordinates of a given vector relative to a given basis.

5. Write a given vector as a linear combination of a set of vectors.

6. Solve geometric problems in two and three space.

7. Solve a system of homogeneous or nonhomogeneous linear equations by Gausian Elimination.

8. Use the properties of the determinant function to test a set of vectors for linear independence.

9. Prove basic properties of matrix algebra.

10. Determine the rank of a set of homogeneous linear equations and a set of basis vectors for the solution space.

11. Find the inverse of a given matrix by Gausian elimination and by cofactors and use this inverse in the solutions of a set of linearly independent equations.

LINEAR ALGEBRA
1Q
MASTERY OBJECTIVES

12. Find basis vectors and parametric equations for the solution space of a given system of equations.

13. Determine the subspace generated by a given set of vectors and the orthogonal complement of this subspace.

14. Find the projection of a vector into a given subspace and the linear transformation that will map a given vector into a designated image.

15. Find the eigenvalues and eigenvectors of a two-dimensional linear transformation and use them to find a basis relative to which a general quadratic function can be represented by a diagonal matrix.

LINEAR PROGRAMMING

10

MASTERY OBJECTIVES

1. Identify the variables and state algebraically the objective function, the constraints, and the nonnegativity requirement for a given linear programming model.

2. Graph the constraints and identify convex and extreme points, the area of feasible solutions and values of the variables that optimize the objective function for a given linear programming model.

3. Prepare a formal statement of a linear programming model using slack variables, and solve for the optimal strategy using the Simplex method.

4. Compute the vector ranges of a linear programming model, display the ranges graphically, and explain their significance.

5. State the range of variation permitted in the slope of the objective function with no change in the optimal solution and use this information to decide on a production strategy for a given linear programming production model.

6. Solve a given problem situation with a set of constraints and requirements, and set up a linear programming model.

7. For a linear programming model solved by the Simplex method, interpret the final tableau for optimal strategy and limiting factors, compute the solution vector and objective function coefficient ranges, and explain the significance of these ranges.

8. Adapt the problem situation to the linear programming model by segmentation, multiple tableaus, or approximation by a curvilinear objective function.

LINEAR PROGRAMMING
1Q
MASTERY OBJECTIVES

9. Use Goal Programming to find satisfying solutions to linear programming models with ranked goals.

10. Use linear programming to find solutions to transportation and other practical situational problems.

APPROVED LIST of BASAL TEXTS

Grades 1 - 8

Title of Text	Grade	Publisher	Term of Adoption Beginning-Ending
Elem. School Mathematics 2E	1	Addison	1970-1974
Elem. School Mathematics 2E	2	Addison	1970-1974
Elem. School Mathematics 2E	3	Addison	1970-1974
Continuing With Mathematics	4	American	1971-1976
Exploring Elem. Mathematics	4	Holt	1971-1976
Modern School Mathematics	4	Houghton	1971-1976
New Dimensions in Mathematics	4	Harper	1971-1976
Sets And Numbers, RV Ed.	4	Random Hse-Singer	1971-1976
Thinking With Mathematics	5	American	1971-1976
Exploring Elementary Mathematics	5	Holt	1971-1976
Modern School Mathematics	5	Houghton	1971-1976
New Dimensions In Mathematics	5	Harper	1971-1976
Sets And Numbers RV	5	Random Hse-Singer	1971-1976
Exploring Elementary Mathematics	6	Holt	1971-1976
Improving With Mathematics	6	American	1971-1976
Modern School Mathematics	6	Houghton	1971-1976

APPROVED LIST of BASAL TEXTS (cont'd)

Grades 1 - 8

Title of Text	Grade	Publisher	Term of Adoption Beginning-Ending
New Dimensions In Mathematics	6	Harper	1971-1976
Sets And Numbers, RV	6	Random Hse-Singer	1971-1976
Modern School Mathematics: Structure And Use	7	Houghton	1974-1979
Target: Meeting Mathematics	7	American	1974-1979
Success With Math	7	Addison	1974-1979
Modern School Mathematics: Structure And Use	8	Houghton	1974-1979
Target: Meeting Mathematics	8	American	1974-1979
Success With Math	8	Addison	1974-1979

APPROVED LIST of BASAL TEXTS
Grades 9 - 12

Course	Title of Text	Grade	Publisher	Adoption Period
FUNDAMENTALS OF MATHEMATICS 1Q, 2Q, 3Q	Elements of Mathematics	9	Silver	1976-81
	Success with Mathematics	9	Addison	1976-81
	Trouble Shooting Mathematics Skills	9	Holt	1976-81
FUNDAMENTALS OF MATHEMATICS 4Q, 5Q, 6Q	Consumer Related Mathematics	10-12	Holt	1971-75
	Mathematics with Business Applications	10-12	Addison	1971-75
INTRODUCTION to ALGEBRA 1Q, 2Q 3Q	Preparing to Use Algebra	9-12	Laidlaw	1976-81
INTRODUCTION to ALGEBRA 4Q, 5Q 6Q	Introductory Algebra Book 2	10-12	Harcourt	1971-1975
ALGEBRA 1 1Q, 2Q, 3Q	Algebra, 2nd. Ed.	8-12	Addison	1971-1976
ALGEBRA 2 4Q, 5Q, 6Q	Modern School Math. Algebra-Trig. 2	9-12	Houghton	1971-1976
GEOMETRY 1Q, 2Q, 3Q	Geometry, 2nd Ed.	9-12	Addison	1969-1974

APPROVED LIST of BASAL TEXTS
Grades 9 - 12 (cont'd)

Course	Title of Text	Grade	Publisher	Adoption Period
TRIGONOMETRY 1Q	Modern Trigonometry	11-12	Houghton	1973-1977
ANALYSIS 8 1Q, 2Q	Pre-Calculus Mathematics	11-12	Addison	1976-1981
CONSUMER MATHEMATICS 1Q, 2Q, 3Q	Mathematics for the Consumer 1E	11-12	So-Western	1972-1976
	Consumer Mathematics	11-12	Harcourt	1972-1976
ANALYTICAL GEOMETRY 1Q	Analytical Geometry	11-12	Addison	1976-1981
COMPUTER MATH 1Q, 2Q, 3Q	Computer Methods in Mathematics	10-12	Addison	1976-1981
CALCULUS	Elements of Calculus	12	Addison	1976-1981
	Calculus Incl. Analy. Tical Geometry	12	Ginn	1976-1981
	Calculus with Analytical Geometry	12	Prentice	1976-1981
PROBABILITY & STATISTICS	Elements of Probability	11-12	Scott	1976-1981
	Introductory Statistics & Probability	11-12	Houghton	1976-1981
INDEPENDENT STUDY	Math & the Modern World	10-12	Addison	1976-1981
	Patterns in the Sand	10-12	Macmillan	1976-1981