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The use of a computer assisted learning program for teaching and reinforcing the basic mathematical skills

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THE USE OF A COMPUTER ASSISTED LEARNING PROGRAM FOR TEACHING AND REINFORCING THE BASIC MATHEMATICAL SKILLS

A Project
Presented to the
Faculty of
California State University,
San Bernardino

In Partial Fulfillment of the Requirements for the Degree Master of Arts in Education: Middle Grades Options

by
Benny Edward Boswell
Henrietta Gale Boswell
September 1999
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ABSTRACT

The purpose of this project is to provide an instructional computer program that will be an alternative way to teach and reinforce basic mathematics skills for any student that is having difficulty in any given area and for students that are falling behind in the regular math class. This allows the teacher the ability to assign the areas that the student needs extra help in. The program is made up of forty different lessons of basic math skills. The student can practice, and then take a quiz after he/she has reached at least a seventy percent level during the practice. The score that the student makes during the practice and the quiz is kept by the computer for the convenience of the student and the teacher. The program is a supplement for the regular mathematics program and does not take the place of it.

Student performance in mathematics according to TIMSS (The Third International Mathematics and Science Study) put our nation below average compared to 41 nations.

In mathematics, our students are far behind Singapore, and Japan which are among the top-scoring nations in the world in both math and science. The scores of our very best U.S.eighth graders, who perform at the 95th percentile for our nation, are not significantly different than the scores of average eighth graders in Singapore, who perform at their nation's 50th percentile.
ACKNOWLEDGMENTS

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CHAPTER ONE

General Introductory Remarks

This has been a joint project with all parts being cooperatively produced. The major portion of the HyperCard programming was done by Ben and the major part of the research was done by Gale.

As teachers, we find it alarming that the students' math test scores and classroom performance are so low. They are unprepared for the higher mathematics because they have not attained the basics that they require. We find that they are missing the knowledge and or ability to do addition, subtraction, multiplication, and division, as well as other basic skills. These are necessary skills in order to understand and do the higher math skills.

The standardized test scores program for the Palm Springs Unified School District were alarmingly low and we, as math teachers, sought to find a way to better instruct these students. We used the HyperCard program to develop a program for teaching and assessing basic math skills, such as addition, subtraction, multiplying, and division. This project contains a HyperCard program that provides practice and testing in forty basic mathematics skills, considered necessary before algebra. This does not address algebra at all but focuses on the skills necessary to be "algebra-ready." This is not meant to be a course; rather, it is supplemental material intended for assessment, practical practice, and learning of basic math skills.
General practice problems in forty different math areas will be generated randomly by the program. The students will attempt to solve these problems. The program will keep each student's test score. The student cannot take a progress self-test until he/she has achieved a score of seventy percent or better in the practice problems. In each skill area ten practice problems are generated, which the student solves. If the student is successful in the practice, the program randomly generates ten new practice problems. The program records the score upon completion of each ten practice problems.

The following is a list of all the basic skills that are in the program.

- Addition of Three Digit Numbers
- Addition of Numbers With Three Decimal Places
- Addition With Mixed Numerals
- Adding Improper Fractions
- Addition of Fractions with Like denominators
- Addition of Fractions with Unlike Denominators
- Subtraction
- Subtraction with Zeros
- Subtraction of Decimals
- Subtraction of Decimals with Zeros
- Subtraction with Mixed Numerals
- Subtracting Fractions with Unlike Denominators
- Multiplication by 2 and 3 Digits
- Multiplication by 3 Digit Numbers
- Multiplication by Decimals
- Multiplying Decimals by Decimals
Teachers have the option to let the student use the calculator, built into the program. This feature is available for practice or testing and can be turned off for testing only.
Significance of the Project

According to the Individual Testing of Academic Skills (ITAS) scores, a large majority of the students entering high school are not ready for algebra. Without the basic mathematics skills, students have a very difficult time in an algebra class. According to informal evaluation in the High School, sixty percent or more of the incoming freshmen fail beginning Algebra I classes. Basic math skills are a necessity to prepare students for high school and college. The skills lacking include basic addition and subtraction facts, multiplication and division facts, lack of understanding place value and decimals, almost no comprehension of percents in relation to decimals, inability to read a word problem and decide how to tackle the problem, and no real understanding of functions and variables in a problem. They are some of the skills they will need to be successful in day to day living and making their way in the world.

The goal of this HyperCard program will provide clear and coherent messages about mathematics. Students will display proficiency in certain levels before moving on to higher levels and thus be more "Algebra-Ready": when leaving the eighth grade. This project has been prepared especially for middle school Mathematics teachers and is useful for any teacher, nation-wide, who is concerned about preparing students for algebra. This program is realistic about the skills approaches and subject matter that make up a viable mathematical background of the individual students.
This program requires technology such as computers; including graphics, calculators and computer generated problems. The problems in this program represent the appropriate level of understanding. No pre-algebra need is ignored. Students need the experiences with math and technology, and they also need extensive skills in rules for mathematics. Inadequate attention to many of these areas is the reason that students are not prepared for algebra. This program is significant because it recognizes these inadequacies and addresses them in a cogent manner, including graphics and problem solving ways that students may learn interactively while learning actively.

Statement of Needs

The purpose of this project is to teach basic math skills through an interactive computer program implemented by HyperCard. This is not a replacement for the regular math curriculum, but a supplemental program to help the students with special needs, or extra practice to master a particular skill.

This program delineates characteristics of middle school students who have mathematical maturity to be "algebra ready".

• Mathematics makes sense. Students should perceive mathematics as a way of understanding.
• Students should be at ease using their mathematical background to solve unfamiliar problems in both concrete and abstract situations.
• Students should have enough genuine success in solving problems to be confident and thus to be tenacious, in their approach to new ones.
• Students need to be able to communicate their understanding of mathematics with peers and teachers using both formal and natural languages correctly and effectively.
• Students should realize that their own minds are their most important mathematical resource and that they are unique and no two minds are exactly alike.
• An openness to the use of appropriate technology and their awareness of the limitations of this technology will enable students to determine when technology will be useful in problem solving and when it cannot be useful. Mathematics is true to the rules. If the rules are followed properly, the answer will be correct.

Research shows that there are six different levels of learning. It is the goal of middle school teachers to help students achieve more complex levels. The different levels are:

• statement of facts
• restatement of facts in child’s own words
• showing or doing, using information
• breaking a whole into parts
• building a new whole from parts
• making judgments from the facts

The traditional way of teaching math develops only the first two levels of learning. Teaching math interactively
fosters all of the different levels for complete mastery of these skills.

Program Plan

The program has benefits for both the student and the teacher:
- To aid at-risk students in learning basic math skills.
- To give extra practice in any of the defined areas.
- Can be used by self-motivated students to build skills.
- Teachers may use the program to test students skills in any particular area.

Goal: To aid at-risk students in learning basic math skills.

Objective 1: Practice and grading of forty basic math skills

Title: HyperCard Program - Basic Math Skills

Strategy: Students will be introduced to the program. Student will obtain competency adding 3 digit numbers, etc.

Evaluation: Students will achieve at least seventy percent competency.

This model will be used through all forty lessons of the program.

Objective 2: Students will learn the benefit of using the computer as a manipulative, which teaches them better math skills. In addition, it will become apparent that their own confidence in using the computer to solve math problems has been enriched.
Title: Classroom participation

Strategy: Hands on experience with Math program and computer

Evaluation: Teacher observation: subjective Computer generated test results objective

Objective 3: Parent participation in the program

Title: Teacher generated information form sent to parent informing them of the program and obtaining permission from parent for student to be in the program. Parents will also be invited to visit class and ask questions about the class.

Strategy: Parent conferences with student using computer generated results to discuss student performance with parents. Discussion will include ways to improve performance.

Evaluation: Teacher observation: subjective Computer generated test results objective

Limitations and Delimitations

The following limitations apply for this project:

- Lack of motivation within student population. Far too many of the students view school as a social club, and any kind of academic learning seems to get in the way of their socializing.

- Lack of computers available in numbers sufficient to address all student needs. There are very few, if any,
computers in the class rooms, and the computer lab is not available for teachers to bring their students.

• All students' interests are stimulated differently. Some students do fine in a classroom setting, while other students work best by themselves, on a one to one setting. Others can learn better interacting with a computer.

The following delimitations are used to address the above limitations. In regard to lack of student motivation: It is critical that student confidence be built upon genuine success; false praise has the opposite effect. Genuine success can be built when student succeed in solving basic mathematical problems. This program has been designed so students can be successful in achieving this goal.

In regard to the lack of computers: The computer lab is not available all periods of the day and not all math classes have computers in the class room. Grants can be written and computer pilot programs can be implemented.

In regard to students' interests are stimulated differently: Student can be comfortable using technology to check their answers, to formulate revised answers, and to make conjectures based on these results.

Assumptions

The following assumptions are pertinent to this project:

• Past experience includes department chairships in mathematics and computer technology - it is assumed that funds will be available to implement this program.
• The Palm Springs Unified School District will approve this program.

• Nationwide there is a special emphasis in "Back to Basics" mathematics which includes continuing research to motive students to learn. It is assumed student will learn when effectively taught or exposed to teaching.

• Resources are available to implement this program.

• This program is available to any other interested teachers.

• Not every student needs to take the course, because it is supplemental and non-linear, which allows the teacher to customize the program and assign only those skills that need remediation.

• Computers are manipulative because of the graphical user interface which requires eye/hand coordination skills, to interact with the program, using a mouse and keyboard.

• Students accept the computer as a non-threatening entity.

• Non-threatening atmosphere, when the student interacts with the computer - there is no embarrassment when wrong, therefore students feel comfortable to try again.

Definition of Terms

Apple Computer, Inc.

algorithm: A step-by-step procedure for solving a problem or accomplishing a task. Writing HyperTalk handlers or programs in other languages often begins with figuring out a suitable
algorithm for a task.

background: A type of HyperCard object; a template shared by a number of cards. Each card with the same background has the same picture, fields, and buttons in its background layer. Like other HyperCard objects, every background has a script. You can place handlers in a background script that you want to be accessible to all the cards with that background.

background button: A button that is common to all cards sharing a background.

background field: A field that is common to all cards sharing a background; its size, position, and default text format remain constant on all cards associated with that background, but its text can change from card to card.

button: a type of HyperCard object; a rectangular "hot spot" on a card or background that responds when you click it according to the instructions in its script. For example, clicking a right arrow button with the Browse tool can take you to the next card.

button tool: The tool you use to create, change, and select buttons.

card: A type of HyperCard object; a rectangular area that can hold buttons, fields and graphics. All cards in a stack are the same size. Each layer can contain its own buttons, fields, and graphics.

card button: A button that belongs to a card; it appears on, and its actions apply to, a single card.

card field: A field that belongs to a card; its size, position, text attributes, and contents are limited to the card on which the field is created.
card picture: A picture that belongs to and which applies only to a specific card.

container: A place where you can store a value (text or a number). Examples are fields, the message box, the selection, and variables.

expression: A description of how to get a value; a source of value or complex expression built from sources of value and operators.

factor: A single element of value in an expression.
field: A type of HyperCard object; a container in which you type field text (as opposed to Paint text). HyperCard has two kinds of fields - card fields and background fields.
field tool: The tool you use to create, change, and select fields.

HyperCard: A scripting language application that enable you to customize buttons and other parts of HyperCard stack for your own purposes.

HyperTalk: The HyperCard built-in script language for HyperCard users.

number: A character string consisting of combination of the numerals 0 through 9, optionally including one period (...) representing a decimal value. A number can be preceded by a hyphen or a minus sign to represent a negative value.

object: An element of the HyperCard environment that has a script associated with it and that can send and receive messages. There are five kinds of HyperCard objects: buttons, fields, cards, backgrounds, and stacks.

Operator: A character or group of characters that causes a particular calculation or comparison to occur. In HyperTalk, operators operate on values. For example, the plus sign (+) is an arithmetic operator that adds numerical values.
picture: Any graphic or part of a graphic, created with a Paint tool or imported from an external file, that is part of a card or background.

put: A command used to put items into a variable, a field or the message box; put 3+4 into x; Put 3+4 into field x; put 3+4 into message box.

script: A collection of handlers written in HyperTalk and associated with a particular object. You use the script editor to add to and revise an object's script. Every object has a script; even though some scripts are empty, that is, they contain nothing.

stack: A type of HyperCard object that consists of a collection of cards; a HyperCard document.

variable: A named container that can hold a value consisting of a character string of any length. You can create a variable to hold some value (either numbers or text) simply by using its name with the put command and putting the value into it. HyperCard has local variables and global variables.
Benchmarks and Standards

To many educators, parents, business leaders, and politicians, "high academic standards" have become the best hope for saving America's schools. Standards are tools that must be used skillfully if they are to get the job done. There is little agreement, within this group, on exactly what needs to be done and what training of teachers is necessary. How far can the development of high academic standards carry the reform movement? Are there any side-effects? What are the most critical steps and what other tools are needed?

The Toronto Board of Education, has 114 elementary schools with approximately 41,000 students and 39 secondary schools with approximately 30,000 students. In May 1987, the board mandated the development of standards for students' achievement in mathematics and language at the end of grades 3, 6, 8, and 10. Until this time no system wide testing or standards had existed. Guidelines had been established for evaluating students and reporting to parents, but schools and teachers were left to work out their own procedures. The board's mandate grew out of parents' need to have better information about the progress of their children. Parents were no longer satisfied with reports from teachers that stated generally that their children were doing just fine. Parents were asking, "compared with what?" Over the next three years, standards, now known as benchmarks, were
developed for grades 3, 6, and 8.

Benchmarks describe what students can do. Both analytic and holistic scoring were used. Using analytic scoring, students' work was marked correct or incorrect and success rates were calculated. Holistic scoring was used for most of the videotaped performances and some of the written work. Using holistic scoring, each student's performance was rated at one of five levels by observing the whole performance and taking into account content, process, and effect. As well as observing the correctness of a student's work, thinking strategies and such elements as perseverance and risk taking were considered. The descriptors, or observable behaviors, for the holistic level were drawn from the students' performances by the teachers, working in small groups. These descriptors are called "holistic criteria."

The benchmarks are descriptions of what our students can do on a wide variety of tasks. The statistical results were not converted to normal distributions. Students did better in some activities than in others. The holistic-scoring criteria were drawn from observations of actual students' performances. They were not determined in advance as a set of expectations or statements of what our students should be able to do to receive a high rating. This distinction between descriptions of what our students can do and what they should be able to do is important in understanding the Toronto benchmarks.

The benchmarks program offers a unique opportunity to observe the thinking of students. By basing the assessment primarily on good classroom activities, rather than on narrow
objectives, it was possible to see how students solve problems. The holistic criteria for high-level performances across the benchmarks contain rich descriptions of the strategies students use. These include working systematically, searching for patterns, monitoring one's thinking, being confident, and enjoying the challenge of a task. The videotapes lend an opportunity for teachers to see demonstrations of these higher-order thinking skills in actual students' performances. The benchmark team is convinced that the combination of holistic scoring and observation is a powerful way to evaluate higher-order thinking skills.

Assessment teams believe that the following are the strengths of the Toronto Benchmarks program.

1. Alignment of evaluation with curriculum: The standards of students' achievement described by the benchmarks are based on classroom activities that incorporate the use of manipulative materials, problem solving and posing, students' oral explanations and reasoning, and experiential approaches. In this sense, they marry learning and evaluating, teaching and testing.

2. Program modification: In the process of working with the benchmarks, teachers not only consider how to evaluate students more accurately but also discuss ways in which their classroom programs can be improved. This aspect, in the long run, may have the greatest impact on standards.

3. Professional development: The videotapes depict an experience that teachers can share. Watching actual
students' performances can serve as a catalyst for meaningful discussions of many issues. Teachers as researchers can conduct their own inquiry into learning.

4. Teachers' professionalism: Giving teachers the responsibility for shaping the use of benchmarks respects their professionalism. In the long run, teachers make the difference in education. Their sense of control and self-esteem are crucial components in the change to more effective schools.

5. Stability: The benchmark libraries are found in every school, and all teachers are required to use them. This presence should lend a sense of purpose to our system and have a stabilizing effect on existing programs, methods, and standards. Other initiatives can be integrated with implementations of the benchmarks. This is a Canadian program and our school district has no such program.

The American Association for the Advancement of Science (AAAS) has been involved in the standards-based K-12 science and mathematics education reform movement.

Project 2061 has been an ongoing project for almost a decade. (American Association for the Advancement of Science 1997,) It has been in the vanguard of efforts to define knowledge and skills that all students should have in mathematics and technology and to center other education reforms on these goals. The project also encourages educators to consider the interdependent nature of the educational system and the implications of reform in one area and the influence it has in other areas.
The project 2061 highlights the needs of the American business leaders, parents, and politicians for higher academic standards in the American schools. Several goals were marked: Develop high academic standards; hold teachers, students, and schools accountable; then administer rewards and punishments as needed. What was it that was needed? Was it to meet the goal of having US students lead the world in science and mathematics or just to have students more literate? The question also arose as to whether development of high academic standards can carry reform movement.

This project has worked extensively with a wide variety of community-based entities including churches, clubs, museums and science centers, the media to expand the participation of math in women, minorities, and people with disabilities and to increase public understanding and appreciation of science and mathematics.

In the area of mathematics, the focus of this paper, student achievement, as measured by the national assessment of the educational process, declines steadily from 1970 through early 1980’s from an already unacceptable level. The release in 1983 of “A Nation at Risk” warned of a national education crisis, and dozens of reports issued over the next few years supported the commission’s conclusions and called for action. (National Commission on Excellence in Education. A Nation at Risk: The Imperative for Education Reform. (1983))

In response to these alarms, a number of new reform efforts began, spurred on by the historic 1989 summit of governors, corporate leaders, and educators in Charlottesville, Virginia. Once again, the reform landscape
was soon crowded with projects, initiatives, collaborative centers, institutes, partnerships, consortia, and more. The most promising of these to emerge over the past decade or so share two common concerns: improving the quality of mathematics education and increasing the accessibility of mathematics education to students who had not participated previously. These concerns are reflected in the National Education Goals and their emphasis on high achievement, particularly in mathematics, by all students. According to the Nation's Education Goals' call for improved academic achievement, is the "belief that its attainment is dependent on the development of rigorous academic standards" (National Education Goals Panel 1995).

Today in mathematics such standards already exist, although they have yet to be fully implemented in the nation's schools (Zucker, Young, and Luczak 1996). In 1989, Project 2061 of the American Association for the Advancement of Science released "Science for All Americans", a report to the nation on what constitutes literacy in science, mathematics, and technology and the steps necessary to achieve it. Later that year, the National Council of Teachers of Mathematics (NCTM) released its Curriculum and Evaluation Standards for School Mathematics the first set of such guidelines to be labeled "standards".

One question often raised is why we need national standards and a new system of voluntary assessments. Don't parents already have the information they need to make judgments about the effectiveness of their local schools? There is evidence that they do not: despite clear indications
that students achievement is low and widespread concern about this, most parents express satisfaction with their children’s achievement and schools.

This analysis focuses on math achievement because of its importance for today’s students. Research indicates that both the number of courses taken and the level of performance in math impact students’ future job prospects and earnings. This is the case for those who enter college and those who enter the job market. Both will need math in their jobs and to expand their careers just as they need it in their everyday lives. Students are neither taking very many math courses nor doing very well in them. According to the 1990 mathematics assessment conducted by National Assessment of Educational Progress (NAEP):

• One in three eighth graders cannot solve two-step problems using addition and subtraction and one-step problems using multiplication and division problems typically taught at the upper elementary school level.
• Eighty six percent of eighth graders cannot consistently solve problems involving fractions, decimals, percents, and simple algebra-- topics generally introduced by the seventh grade.

Despite this low achievement, a majority of parents of eighth grade students surveyed for NELS:88 (National Education Longitudinal Survey of 1988) parents of public and private school students alike, believe that their own child’s school was doing a good job of preparing students for further education.

• Four out of five parents of eighth grade students in
public schools and nine out of ten parents of eighth grade students in private schools agreed that their child's school was doing a good job of preparing students for high school.

Two out of three parents of eighth grade students in public schools and four in every five parents of eighth grade students in private schools agreed that the school was doing a good job of preparing students for college.

The paradox of high parental satisfaction in the face of evidence of poor student performances suggests that most parents have no common standard against which they can judge their own children's achievement. It was found that while parents whose children are not doing well in math are somewhat less satisfied with their children's schools than are parents whose children are doing well, a majority still believe that their children's schools are doing a good job of preparing students for high school and college:

- Seventy-five percent of parents of the lowest achieving students on the math test believed that their children's schools were doing a good job of preparing students for high school.

- Sixty-one percent of parents believed that the schools were doing a good job of preparing students for college.

This pattern is true for both public and private schools. In fact, a greater percentage of the parents of the lowest achieving private school students believe that the school is preparing students well for college.

What about parents of children in high poverty schools (i.e., schools with large concentrations of children from
poor families)? Research has shown that children in high poverty schools are much more likely than other children to leave school unprepared for the work force or for further education.

Despite such low performance, according to NELS:88 data these parents are satisfied with the quality of their children's education:

• Three of every four parents of students in high poverty schools believed that the schools were preparing students well for high school.

• Nearly sixty percent believed that the schools were preparing students well for college.

What accounts for such a high level of parental satisfaction, when the children are doing so poorly? It may well be that parents have limited ways of judging how well their children are doing. How do parents know if report cards filled with A's mean their children are learning what they should in the eighth grade? How do parents judge whether their children's eighth grade classes are challenging or mediocre?

Parents have to rely primarily on grades to determine how much their children are learning, and according to the grades, their children are doing well. A majority of eighth grade students surveyed by NELS:88 reported that they have received "mostly A's" or "mostly B's" in math from grade six through grade eight.

• Sixty-six percent of public school students reported getting mostly A's or B's in math, and

• Seventy-five percent of private school students reported
A's or B's as well.

Did two out of every three of the eighth grade students surveyed by NELS:88, really do well in math? While students who scored poorly on the NELS:88 math test were less likely to report getting A's and B's than students who did well on the test, forty-five percent of the eighth grade students who scored in the bottom quarter on the math test reported getting mostly A's and B's.

Parents may reasonably conclude from these grades that their children are doing well, when, in fact, the children may not be learning the math they need for further education and work in today's world.

Parents cannot rely solely on their children's grades to determine the quality of their education. In order to ensure that their children are receiving a world class education that prepares them for the 21st century, parents need external standards against which they can assess the performance of their children and their children's schools.

In math, curriculum standards have been developed by the National Council of Teachers of Mathematics (NCTM). These standards identify the areas of math students should study in grades K through 12. Similar standards are being developed in other subject areas.

Parents should ask their school principal for a copy of the NCTM standards and how they are being implemented in the school curriculum. While these standards provide guidance on what children should study in math, they do not provide parents with information on how well their children are doing. Therefore, parents may also want to ask their
children's teachers about the education their children are receiving. For example:

- Is my child working at the appropriate grade level? If not, what help is my child receiving to work up to grade level?
- What does my child's grade of A or B mean? Is my child being measured against a standard, or being compared to classmates?
- Are the students who get A's and B's in my child's eighth grade class well prepared for high school? What classes do they usually go into in high school?
- How well prepared are these students for college? How do you know that they are well prepared?
- Are the students who get A's and B's in my child's high school classes well prepared for work? What kinds of jobs do they get?

Parents should ensure that they have the information they need to judge what their children know and can do.

Standardized Tests

American College Testing (ACT) was founded over thirty years ago by E.G. Lindquist, who believed that a college-entrance test should measure as directly as possible examinees' ability to do the kinds of tasks required in college and beyond. In the instance of mathematics, Lindquist believed that the test should focus on the outcomes of secondary mathematics education that are necessary for successful performance in college courses; it should be a
test of achievement (acquired or developed abilities) and should consist of tasks that correspond to recognized high school learning experiences. This test should be designed so that examinees must use their acquired skills and knowledge to complete complex, heterogeneous tasks successfully.

SKILLS LEVELS

The three skill levels—basic skills, application, and analysis reflect the kinds of skills desirable for examinees' success in high school and college. Can the examinees apply what they know? Can they reason and analyze? Do they understand essential concepts and procedures? Can they integrate information, as recommended for assessment in Evaluation Standard 4: Mathematical Power (NCTM 1989, 205)? The intent of Evaluation Standard 2: Multiple Sources of Information (p.241) is also reflected here, in that examinees are asked to demonstrate what they know in a variety of formats and contexts.

The three levels of skill can be defined operationally:

• Basic-skills problem can be solved by performing a familiar series of operations in a familiar setting.

• Application problems can be solved by performing familiar sequences of operations, but the solution is not routine. Either the setting is unfamiliar, the solution involves putting together several sequences of familiar operations, or the solution involves translation between different forms of mathematical expression. "Story" problems nearly always appear in this category, but not all application problems need be
expressed in an extra-mathematical framework.

- Analysis problems demand the deepest understanding. Examinees must know, for example, why and when a familiar sequence of operations yields a solution or how to break a problem down into component parts and examine the various parts to arrive at a solution.

American College Testing requires its writers not only to meet content and skill-level criteria for their questions but also to develop realistic and interesting questions. They are asked to produce questions that meet, as closely as possible, the following criteria, which are consistent with the evaluation standards, particularly Standard 10: Mathematical Disposition (NCTM 1989, 233):

- Questions should cover important areas of mathematics, not obscure theorems. The object is not to trick the unwary but to differentiate between well-prepared and poorly prepared examinees.
- Questions should not be oversimplified but should present typical problems that an examinee might face in the classroom or in the world beyond the classroom.
- Questions should not be offensive to either sex nor to any ethnic, geographic, or other demographic subgroups.

The test is finally assembled to meet technical specifications that require the questions to be within a prescribed range of difficulty, in which fifteen percent to ninety percent of the examinees can answer individual questions correctly and examinees can answer correctly an average of fifty-eight percent of the questions on the entire test. The questions must also differentiate well between
better-prepared and poorly prepared examinees.

National Council of Teachers Mathematics met in 1987 because of a concern that math teachers are inadequately prepared in the area of educational assessment. Their deliberations resulted in "Standards for Teacher Competence in Educational Assessment of Students" (1990). The seven standards list the most desirable levels of knowledge and skill in assessment to be attained by teachers.

Standards for Teacher Competence in Educational Assessment of Students

Standard 1: Teachers should be skilled in choosing assessment methods appropriate for instructional decisions.

Standard 2: Teachers should be skilled in developing assessment methods appropriate for instructional decisions.

Standard 3: Teachers should be skilled in administering, scoring, and interpreting the results of both external-produced and teacher-produced assessment methods.

Standard 4: Teachers should be skilled in using assessment results when making decisions about individual students, planning, teaching, developing curriculum, and school improvement.

Standard 5: Teachers should be skilled in developing valid pupil grading procedures which use pupil assessments.

Standard 6: Teachers should be skilled in communicating assessment results to students’ parents, other
lay audiences, and other educators.

Standard 7: Teachers should be skilled in recognizing unethical, illegal, and otherwise inappropriate assessment methods and uses of assessment information.

The role of the mathematics teacher as assessment developer raises two issues, both of which deal with alignment. The first issue involves the classroom assessment objectives and those of the standardized test. Mathematics teachers make many informal judgments of students' progress with respect to their own pre-established objectives. If these objectives are directly aligned with those of the standardized mathematics test, then no problem exists. However, many instances of misalignment occur between classroom assessment practice and standardizing testing. For example, the National Council of Teachers of Mathematics evaluation standards encourage the use of calculators in the mathematics assessment. Teachers who develop classroom tests that encourage the use of calculators may find themselves in conflict with standardized tests that forbid their use.

The second issue involves the same idea - the difference between classroom practice and the assessment method. Most teachers employed, cooperative grouping to raise achievement levels - However, no acceptable method of testing the individual, outside their group, has been developed.

The Scholastic Aptitude Test (SAT) remains the single most popular evaluation to determine mathematical skill levels, and readiness for college level mathematics. Group learning activities do little to prepare students for this
type of test.

The content of the current SAT instead of only arithmetic word problems, tests content in arithmetic, algebra, and geometry. In addition, several questions classified as "miscellaneous," test such topics as properties of the number system, elementary number theory, logical analysis, simple probability, and newly defined function-like operations.

The College Board and Educational Testing Service (ETS) have been involved in a major research effort to investigate possible changes to the current SAT. These are among the broad goals of the investigation.

- To make the test more closely related to the current mathematics curriculum.
- To begin moving away from an exclusively multiple-choice test.
- To increase the usefulness of scores derived from the test.
- To reduce the impact of speed on students' performance.

In the ideal testing situation, students would be presented with open-ended problems and the students' solutions would be scored for quality and correctness by trained graders. However, with more than 1.8 million SAT's taken annually, such an open-ended approach is not economically feasible.

One major topic of concern is the use of calculators on the test. Equity issues involved in calculator use were addressed through a questionnaire mailed to several hundred mathematics faculty in urban and rural schools. Highlights
of the results of the urban and rural questionnaire were as follows:

- Respondents in both urban and rural schools indicated that most of their college-bound students own or have regular access to calculators.
- Most indicated that ninety percent or more of their college-bound students are able to use calculators to perform the basic arithmetic operations.
- Most indicated that their students would probably do better on the Standardize Achievement Test (SAT) if calculators were permitted. They also indicated that students in their schools (urban and rural) would benefit about the same as students in other types of schools (suburban and private).
- A non programmable scientific calculator was viewed as the most appropriate type to permit. Faculty indicated, however, that some control should be exercised over the calculators allowed. The most frequently given response was to allow students to bring their own calculators chosen from a predetermined list of acceptable models.
- Most faculty indicated that they could not foresee any problems if calculator use were permitted and that they would need less than a year's notice to prepare for the change. (In fact, schools will have approximately three years to accommodate the change.)

In the comments section of the questionnaire, the most common comments and concerns related to equity issues and to cheating. An edited sample of the comments follows:

- Students using more-elaborate (e.g., graphing)
calculators would have an unfair advantage over students using basic-function calculators.

- Certain types of calculators could cause security problems. Would calculator use be monitored?
- The student's ability to use the calculator could influence his or her score.
- Every student should have access to the same type of calculator.
- The SAT-M now measures thinking, mathematics principles, and basic calculation. Save calculators for the achievement test.

The investigation is continuing on the impact of calculator use on certain types of questions. A final decision has not been made about the types and models of calculators that will be permitted.

The fourth National Education Goal adopted by the President and the nation's governors states that our students will become first in the world in mathematics and science achievement by the year 2000 (Off. of Ed. Res. and Imp., 1992). To accomplish this ambitious goal means a major change in mathematics curriculum standards and frameworks. It is the intention that curriculum reform will greatly affect the ways in which students learn and how teachers teach. As a result there will be a need for assessment reform.

Student learning, teacher instruction and assessment should not be separate entities but support each other. Assessment theorist all agree and all interested educators are being made to rethink assessment and how it affects
achievement. Assessment must involve the examination of the processes as well as the product of learning. Meaningful learning is reflective, constructive and self-regulating. (Herman, Aschbacher and Winters, 1992). So, students must assume a growing responsibility for documenting their own progress.

All school districts are now considering the effectiveness of standardized tests. According to Dr. Robert Tierney, (Lecture: Portfolio Assessment. Thursday October 19, 1995, Penfield High School) a Professor and Chairperson for the Department of Education Theory and Practice at the Ohio State University, standardized tests put a restraint on the classroom; dictating what is taught and how. This is against the philosophy that assessment should emerge from the classroom and be congruent with instruction and learning. In the opinion of Dr. Tierney, standardized tests also cannot show the teacher all they want to know about a student. They cannot show the development of the student, how a student has improved over time, but only how a student can perform on that certain test. It can be hypothesize that it is impossible to create a 100% unbiased test.

There are many other criticisms to standardized tests and other conventional assessments (Herman, Aschbacher and Winters, 1992). The belief is that they typically only measure lower level thinking skills and the narrowness of test content is also a concern. The question remains how can the multiple choice format of standardized tests have any relevance in real-world and classroom learning. The
criticism that is most discerning is that there is a "mismatch between test content and curriculum and instruction; the overemphasis on routine and discrete skills with a neglect of complex thinking and problem solving," (Herman, Aschbacher and Winters, 1992, p.5). How can we expect a student to perform well on a test that is not congruent with their instructional environment.

Assessments/Evaluations

The terms testing, assessment, and evaluation are often used interchangeably. Tests are used in the process of assessing students' knowledge to make judgments, or evaluations. Tests are measuring instruments like thermometers and scales. They hold no value in themselves but are one of the many possible tools that are used to assess students' progress. Because testing is the easiest of the three to think about, the tendency is to focus on testing. Evaluation is at the heart of teaching, without it teachers would know neither what students understand nor how successfully they were taught.

Learning used to be thought of as a set of building blocks--discrete skills that had to be acquired in a fairly regular order. Now they refer to networks emphasizing the interconnections among skills, concepts, and contexts. One doesn't understand concepts and then solve problems, one understands concepts by solving problems.

If mathematics is thought of as a coherent set of knowledge, abilities, and dispositions, tests that focus on
separate ideas or particular skills won't suffice. They can't tell us if students understand what they are doing or why they are doing it. It is important for teachers to think big, to consider the basic themes of elementary school mathematics and begin with them. The big ideas include, but are not limited to, measurement, geometric ideas, numeration, patterns and functions, and fractions.

Teachers need to go beyond the end-of-the-chapter questions to assess students's understanding of these big ideas. They need to think in terms of networks of related concepts and skills. Many concepts and skills come into play. Some are:

- Numeration: All measurement requires an understanding of number. How are numbers related? How does the difference between 200 and 200,000 compare with that between 1/16 and 1/8? What does a really large number look like? What is the relationship of parts to a whole, such as one-third of a cup?

- Ratio and proportion: Measurement gives a practical context to ratio and proportion. As students convert from one measuring unit to another, they must recognize the relationship between units, whether they be inches and feet or equilateral triangles and hexagons. They must also understand the inverse relationship that exists between the size of a unit and the number needed to measure a given quantity.

- Spatial thinking: Measurement is grounded in geometry. Often through using and comparing different shapes, students first become aware of size as an important
attribute in describing objects, and it serves as an impetus for making measurements of area, perimeter, and volume.

- Accuracy and precision: Although accuracy and error in measurement may be considered statistical ideas, the act of measuring supplies a practical demonstration that no measurement is completely accurate and that precision depends on the tools employed and the requirement of the task.

- Estimation and reasonableness: In measurement, estimation is seen as more than just a process of rounding numbers or guessing; it is a way of judging reasonableness according to the size of the numbers involved.

- Computation: Finally, measurement entails an understanding that formulas used for calculating are merely shortcuts for counting.

All these concepts and procedures are connected and sometimes subsumed within each other. None are unique to measurement. All are part of any of the central themes of the elementary mathematics curriculum. Whatever themes are assessed, to the greatest extent possible, our assessments should attempt to gain insight into students' understanding of this network. A perfect test or a perfect task does not exist.

One vehicle for an alternative assessment is portfolios. In any subject area and at any grade level they have been found to be an excellent assessment of a student's learning and achievement over a long period of time. Standardized
tests only assess what a student knows now. Portfolios can trace the development of a student’s ability. If nothing else, portfolios open a channel for discussion between instructor and student.

Portfolios are records of students’ work, a type of elaborate grade book that contains not just scores, notes on progress, or percents of correct answers but also the work on which the scores and notes are based. Portfolios are collections of primary data. They can contain tests, worksheets, notes from a journal, descriptions of investigations, solutions for problems, any written work that exemplifies the students’ mathematical activities.

A portfolio is a purposeful collection of student work that exhibits the student’s efforts, progress and achievements. Portfolios have the potential to reveal much about their creators. They can become a window into the student’s minds. They are a means for staff and students to understand the educational process at the level of the individual learner.

Portfolios offer many advantages because they are used as an intersection of instruction and assessment, which, together give more information than separately. Students assume ownership of their portfolio because they participate in the collection and reflection of examples of their work to be included. The portfolio allows a variety of materials to be collected such as the student’s personal goals and interests, as well as, the interests of the teacher, parents and district. Focusing the portfolio on what the pupil can do improves self confidence and pride. Portfolios present
the opportunity for a student to learn about learning.

Another advantage of portfolios is the opportunity they afford for conversations about mathematics. Teachers can use them as prima facie evidence of what is going on in the classroom to communicate their goals and values to parents and others. For students, too, they can act as testaments to growth in skill and understanding.

Portfolios offer a way of assessing student learning that is quite different from traditional methods. They approximate real life, individual achievement and higher level thinking skills; concepts that are associated with authentic assessment. While achievement tests offer outcomes that can be counted, portfolio assessment offers the opportunity to observe students in a broader context, such as, taking risks, developing creative solutions and learning to make judgments about their own performances.

The mathematics portfolios contain several "best pieces" that show good problem solving and show the student's best work. Evaluators look for mastery by students in two areas: math problems solving skills and math communication. These portfolios are examples of student work and should give a better picture of how students are doing.

The value of portfolios depend on the kinds of mathematical activities that they contain. Essentially, they are a method of recording, not a way of teaching or assessing. Furthermore, portfolios show only the product, not the process. Students reveal their understanding in conversations with teachers, in class discussions, and in the give-and-take of group problem solving. They also reveal
much about themselves in how they go about their work. Most thoughtful teachers make penetrating judgments about their students that are not necessarily reflected in the students' final products.

Palm Springs Unified School District has a structured program using portfolios and the overall evaluation from the HyperCard Math Program will be placed in the students portfolios. Also, included will be a paper from problem solving activity.

The Curriculum and Evaluation Standards supports journal writing as a means of establishing connections by encouraging students to explore and write about various strategies for solving the same problem. An example of how students can be asked to consider connections while writing in their journals follows:

The following system of equations can be solved in many ways. Explain three different methods. Which method would you use and why? Example Problem: \( y = x^2 \quad y = x + 1 \)

Why write? Writing is more than just a means of expressing what we think; it is a means of knowing what we think - a means of shaping, clarifying, and discovering our ideas. Adults know that articulation of ideas helps to solidify them. Students, however, may not be aware of this tool that can help them understand mathematics more completely. It is our responsibility to discuss with our students the purpose of keeping a journal. Participation will be more enthusiastic if the students understand the benefits. Initial reaction from the students may be negative because they may perceive that writing takes place in English.
classes not mathematics classes. However, journal writing in mathematics allows students to--

1. participate by communicating ideas, questions, or suggestions when they are too shy or intimidated to do so in front of the entire class;
2. write freely without concern about spelling, punctuation, style, and so on;
3. summarize, organize, relate, and associate ideas;
4. define, discuss, or describe an idea or concept;
5. experiment with, create, or discover mathematics independently;
6. review topics;
7. reflect on class by summarizing goals, strategies, reactions, accomplishments, or frustrations; and
8. openly express positive and negative feelings and frustrations.

Students respond positively if they are aware of the rewards they will gain by writing in their journals. Student eagerly await teachers' responses to their ideas.

The first year of introducing journals in algebra classes brought with it unforeseen difficulties. Students were allowed to take the journals home, it was soon realized that some students wrote all their entries the day before they were collected for evaluation. It was also found that some students wrote the same sentence daily regarding their reactions and responses to their algebra class and were obviously not using the journals as the learning strategy had been designed. For other students, the daily writing was laborious and was not producing the results they had
intended. The evaluation process also posed other problems. Collecting the journals all at once posed an overwhelming grading task, and had initially decided to correct errors in English usage, the work load increased and time efficiency in grading decreased. Despite these problems, they committed to the incorporation of writing journals into our algebra classes.

The second year, they decided that daily journal writing was not necessary. Students are now given five minutes several times a week to write in their journals at the end of a class period. The journals are kept in a secure area in our classrooms to prevent students from writing entries in their journals all at once during a marking period. An assessment will take place at the end of the year whether to revise this program or not.

In the Palm Spring School District, teachers are encouraged to use journals in their classrooms. However, they are not assessed by the district and not all teachers use them.

Problem-solving scored discussion is an alternative form of assessment. Give a group of students a problem, ask them to discuss and solve a problem in a given period of time. Five minutes is a sufficient amount of time to develop a strategy for solving a problem. Students are to be scored on the discussion. Points are assigned according to strategies applied and communication skills exhibited, not on whether a solution was determined. These are the compelling attributes of scored discussions.

- They are easy to score and do not add to the amount of
grading time spent by the teacher.

- They are an alternative form of assessment to traditional paper-and-pencil test.
- They offer opportunities for success to students with different learning styles.
- They permit students to have greater ownership of their own learning.
- They allow students to learn from each other.

Introducing the procedure: The day before the first scored discussion, a practice scored discussion should be demonstrated. Give every student a copy of the evaluation so that each will know the criteria for evaluation. Demonstrate how to make five-point plays by determining a strategy and then draw someone else into the discussion to apply the suggested strategy. Also demonstrate how to lose points by interrupting or monopolizing. Students can score points by thinking aloud and using proper mathematical vocabulary. Not finding "the correct answer" in the allotted time would not hurt the score.

Benefits of scored discussions are: An opportunity to observe students meeting the curriculum standard on mathematical disposition. A second benefit is improved discussions in cooperative groups. For the teacher, the benefit of scored discussions is that the students' grades reflect the experience they have gained in solving problems, reasoning, and communicating in mathematics.

Technology
Two unanswered questions raised by the NCTM’s curriculum standards involve the appropriate use of technology in mathematics classrooms. These questions are; When do we begin to use technology in the classroom? and When do we end our explorations with technology in the classroom?

Technology should be used in the classroom for the same reason it is used in the home. Technology has made it possible for some jobs to be done more quickly and effectively.

For mathematics, the pencil is still the most efficient tool, however, when a calculation can be done more quickly or more effectively with a computer or calculator, then it should be done with one of those tools. The challenge facing us is to make decisions concerning when the tool of choice should be the pencil or when it should be the calculator or computer. By continuing explorations with technology, by looking for new mathematics strategies that couldn’t be used at all before, mathematics education will be improved.

Standards requirements for mathematics are being put into place for students to meet. In order for them to meet the requirements, this project will help accomplish this by using technology so that the student will have more practice and the computer allows the student to make guesses without any embarrassment caused by others knowing that he/she did not know the answer. Students in this technology world seem to react to the computer better than to a human. However, both are needed to accomplish this project.
CHAPTER THREE

Use of the Program and Materials

This program is a tool to aid teachers in teaching basic mathematics skills. This will provide practice and testing in forty different areas of basic mathematics. This program is not meant to be a full course in mathematics, rather it is to be considered as supplemental to any general math class. These applications reinforce and extend student's mastery of basic mathematical concepts.

The computer program provided with this curriculum, is a HyperCard stack that runs on any Macintosh computer, using HyperCard Player, which is installed on all computers, by the Apple operating system and requires no special computer skills of the student or teacher. The program may also be used with the full version of HyperCard which would allow the instructor, who has some experience in the use of HyperCard scripting, to edit the source code procedures, or examine them for new ideas. All necessary files are included on a Compact Disk, and must be copied to the hard drive of the computer, on which it will be used.

The program will generate randomly, ten practice questions in each area. If the student answers the practice questions successfully, seventy percent or better, they will then be offered the option to take a ten question series, as a recorded test grade. These scores will be permanently displayed next to each objective for the student and instructor, to evaluate progress.

These need not to be done in any particular order or by
a specific time line. The instructor can assign practice in any of the forty skills area.

The lesson plans are placed in the order that they appear on the program for convenience, and the instructor can assign any skill module they choose. The need determines the order of use.

The instructions for the program are in Appendix A, as well as the instructions for teachers and students.
Lesson: #1  Addition of Three Digit Numbers

Objective: The students will acquire the knowledge and understanding of adding three digit numbers.

Materials: Computer and the Basic Math Skills Program.

Procedure: The instructor will assign Addition of Three Digit Numbers in the Basic Math Skills Program. The student will be given ten problems to solve. If the student achieves a seventy percent, they then have the opportunity to do another set of problems for a recorded score.

Guided Practice: None. It is assumed that the teacher has already provided the guided practice.

Independent Practice: The student will have a worksheet for homework.

Assessment: The computer records a score on a set of problems after the student has achieved a seventy percent on a practice set.

Closure: Make sure that the students are understanding how to add three digit numbers.
Lesson: #2  
Objective:  
Addition of Numbers With 3 Decimal Places  
The students will acquire the knowledge and understanding of adding three digit numbers.

Materials:  
Computer and the Basic Math Skills Program.

Procedure:  
The instructor will assign Addition of Numbers With 3 Decimal Places in the Basic Math Skills Program. The student will be given ten problems to solve. If the student achieves a seventy percent, they then have the opportunity to do another set of problems for a recorded score.

Guided Practice:  
None. It is assumed that the teacher has already provided the guided practice.

Independent Practice:  
The student will have a worksheet for homework.

Assessment:  
The computer records a score on a set of problems after the student has achieved a seventy percent on a practice set.

Closure:  
Make sure that the students are understanding how to add decimals.
Lesson: #3  
Addition with Mixed Numerals

Objective:  
The students will acquire the knowledge and understanding of adding three digit numbers.

Materials:  
Computer and the Basic Math Skills Program.

Procedure:  
The instructor will assign *Addition with Mixed Numerals* in the Basic Math Skills Program. The student will be given ten problems to solve. If the student achieves a seventy percent, they then have the opportunity to do another set of problems for a recorded score.

Guided Practice:  
None. It is assumed that the teacher has already provided the guided practice.

Independent Practice:  
The student will have a worksheet for homework.

Assessment:  
The computer records a score on a set of problems after the student has achieved a seventy percent on a practice set.

Closure:  
Make sure that the students are understanding how to add mixed numerals.
Lesson: #4  Addition Improper Fractions

Objective: The students will acquire the knowledge and understanding of adding three digit numbers.

Materials: Computer and the Basic Math Skills Program.

Procedure: The instructor will assign Addition Improper Fractions in the Basic Math Skills Program. The student will be given ten problems to solve. If the student achieves a seventy percent, they then have the opportunity to do another set of problems for a recorded score.

Guided Practice: None. It is assumed that the teacher has already provided the guided practice.

Independent Practice: The student will have a worksheet for homework.

Assessment: The computer records a score on a set of problems after the student has achieved a seventy percent on a practice set.

Closure: Make sure that the students are understanding how to add improper fractions.
Lesson: #5  

**Objective:** The students will acquire the knowledge and understanding of adding three digit numbers.

**Materials:** Computer and the Basic Math Skills Program.

**Procedure:** The instructor will assign Addition of Fractions with like Denominators in the Basic Math Skills Program. The student will be given ten problems to solve. If the student achieves a seventy percent, they then have the opportunity to do another set of problems for a recorded score.

**Guided Practice:** None. It is assumed that the teacher has already provided the guided practice.

**Independent Practice:** The student will have a worksheet for homework.

**Assessment:** The computer records a score on a set of problems after the student has achieved a seventy percent on a practice set.

**Closure:** Make sure that the students are understanding how to add fractions with like denominators.
Lesson: #6  

**Addition of Fractions with Unlike Denominators**

**Objective:** The students will acquire the knowledge and understanding of adding three digit numbers.

**Materials:** Computer and the Basic Math Skills Program.

**Procedure:** The instructor will assign *Addition of Fractions with Unlike Denominators* in the Basic Math Skills Program. The student will be given ten problems to solve. If the student achieves a seventy percent, they then have the opportunity to do another set of problems for a recorded score.

**Guided Practice:** None. It is assumed that the teacher has already provided the guided practice.

**Independent Practice:** The student will have a worksheet for homework.

**Assessment:** The computer records a score on a set of problems after the student has achieved a seventy percent on a practice set.

**Closure:** Make sure that the students are understanding how to add fractions with unlike denominators.
Lesson: #7  Subtraction

Objective: The students will acquire the knowledge and understanding of adding three digit numbers.

Materials: Computer and the Basic Math Skills Program.

Procedure: The instructor will assign Subtraction in the Basic Math Skills Program. The student will be given ten problems to solve. If the student achieves a seventy percent, they then have the opportunity to do another set of problems for a recorded score.

Guided Practice: None. It is assumed that the teacher has already provided the guided practice.

Independent Practice: The student will have a worksheet for homework.

Assessment: The computer records a score on a set of problems after the student has achieved a seventy percent on a practice set.

Closure: Make sure that the students are understanding how to subtract whole numbers.
Lesson: #8  Subtraction with Zeros

Objective: The students will acquire the knowledge and understanding of adding three digit numbers.

Materials: Computer and the Basic Math Skills Program.

Procedure: The instructor will assign Subtraction with Zeros in the Basic Math Skills Program. The student will be given ten problems to solve. If the student achieves a seventy percent, they then have the opportunity to do another set of problems for a recorded score.

Guided Practice: None. It is assumed that the teacher has already provided the guided practice.

Independent Practice: The student will have a worksheet for homework.

Assessment: The computer records a score on a set of problems after the student has achieved a seventy percent on a practice set.

Closure: Make sure that the students are understanding how to subtract with zeros.
Lesson: #9  Subtraction of Decimals

Objective: The students will acquire the knowledge and understanding of adding three digit numbers.

Materials: Computer and the Basic Math Skills Program.

Procedure: The instructor will assign Subtraction of Decimals in the Basic Math Skills Program. The student will be given ten problems to solve. If the student achieves a seventy percent, they then have the opportunity to do another set of problems for a recorded score.

Guided Practice: None. It is assumed that the teacher has already provided the guided practice.

Independent Practice: The student will have a worksheet for homework.

Assessment: The computer records a score on a set of problems after the student has achieved a seventy percent on a practice set.

Closure: Make sure that the students are understanding how to subtract decimals.
Lesson: #10  

Subtraction of Decimals with Zeros

Objective: The students will acquire the knowledge and understanding of adding three digit numbers.

Materials: Computer and the Basic Math Skills Program.

Procedure: The instructor will assign Subtraction of Decimals with Zeros in the Basic Math Skills Program. The student will be given ten problems to solve. If the student achieves a seventy percent, they then have the opportunity to do another set of problems for a recorded score.

Guided Practice: None. It is assumed that the teacher has already provided the guided practice.

Independent Practice: The student will have a worksheet for homework.

Assessment: The computer records a score on a set of problems after the student has achieved a seventy percent on a practice set.

Closure: Make sure that the students are understanding how to subtract decimals with zeros.
Lesson: #11  Subtraction with Mixed Numerals

Objective: The students will acquire the knowledge and understanding of adding three digit numbers.

Materials: Computer and the Basic Math Skills Program.

Procedure: The instructor will assign Subtraction with Mixed Numerals in the Basic Math Skills Program. The student will be given ten problems to solve. If the student achieves a seventy percent, they then have the opportunity to do another set of problems for a recorded score.

Guided Practice: None. It is assumed that the teacher has already provided the guided practice.

Independent Practice: The student will have a worksheet for homework.

Assessment: The computer records a score on a set of problems after the student has achieved a seventy percent on a practice set.

Closure: Make sure that the students are understanding how to subtract numbers with mixed numerals.
Lesson: #12  Subtraction of Fractions with Unlike Denominators

Objective: The students will acquire the knowledge and understanding of adding three digit numbers.

Materials: Computer and the Basic Math Skills Program.

Procedure: The instructor will assign Subtraction of Fractions with Unlike Denominators in the Basic Math Skills Program. The student will be given ten problems to solve. If the student achieves a seventy percent, they then have the opportunity to do another set of problems for a recorded score.

Guided Practice: None. It is assumed that the teacher has already provided the guided practice.

Independent Practice: The student will have a worksheet for homework.

Assessment: The computer records a score on a set of problems after the student has achieved a seventy percent on a practice set.

Closure: Make sure that the students are understanding how to subtract fractions with unlike
denominators.
Lesson: #13  **Multiplication by 2 and 3 Digits**

**Objective:** The students will acquire the knowledge and understanding of adding three digit numbers.

**Materials:** Computer and the Basic Math Skills Program.

**Procedure:** The instructor will assign **Multiplication by 2 and 3 Digits** in the Basic Math Skills Program. The student will be given ten problems to solve. If the student achieves a seventy percent, they then have the opportunity to do another set of problems for a recorded score.

**Guided Practice:** None. It is assumed that the teacher has already provided the guided practice.

**Independent Practice:** The student will have a worksheet for homework.

**Assessment:** The computer records a score on a set of problems after the student has achieved a seventy percent on a practice set.

**Closure:** Make sure that the students are understanding how to multiply by two and three digit numbers.
Lesson: #14  Multiplication by 3 Digit Numbers

Objective: The students will acquire the knowledge and understanding of adding three digit numbers.

Materials: Computer and the Basic Math Skills Program.

Procedure: The instructor will assign Multiplication by 3 Digit Numbers in the Basic Math Skills Program. The student will be given ten problems to solve. If the student achieves a seventy percent, they then have the opportunity to do another set of problems for a recorded score.

Guided Practice: None. It is assumed that the teacher has already provided the guided practice.

Independent Practice: The student will have a worksheet for homework.

Assessment: The computer records a score on a set of problems after the student has achieved a seventy percent on a practice set.

Closure: Make sure that the students are understanding how to multiply by three digit numbers.
Lesson: #15  Multiplication by Decimals

Objective: The students will acquire the knowledge and understanding of adding three digit numbers.

Materials: Computer and the Basic Math Skills Program.

Procedure: The instructor will assign Multiplication by Decimals in the Basic Math Skills Program. The student will be given ten problems to solve. If the student achieves a seventy percent, they then have the opportunity to do another set of problems for a recorded score.

Guided Practice: None. It is assumed that the teacher has already provided the guided practice.

Independent Practice: The student will have a worksheet for homework.

Assessment: The computer records a score on a set of problems after the student has achieved a seventy percent on a practice set.

Closure: Make sure that the students are understanding how to multiply by decimals.
Lesson: #16  Multiplying Decimals by Decimals

Objective: The students will acquire the knowledge and understanding of adding three digit numbers.

Materials: Computer and the Basic Math Skills Program.

Procedure: The instructor will assign Multiplying Decimals by Decimals in the Basic Math Skills Program. The student will be given ten problems to solve. If the student achieves a seventy percent, they then have the opportunity to do another set of problems for a recorded score.

Guided Practice: None. It is assumed that the teacher has already provided the guided practice.

Independent Practice: The student will have a worksheet for homework.

Assessment: The computer records a score on a set of problems after the student has achieved a seventy percent on a practice set.

Closure: Make sure that the students are understanding how to multiply decimals by decimals.
Lesson: #17  Multiplication of Numbers Ending With Zeros

Objective: The students will acquire the knowledge and understanding of adding three digit numbers.

Materials: Computer and the Basic Math Skills Program.

Procedure: The instructor will assign Multiplication of Numbers Ending With Zeros in the Basic Math Skills Program. The student will be given ten problems to solve. If the student achieves a seventy percent, they then have the opportunity to do another set of problems for a recorded score.

Guided Practice: None. It is assumed that the teacher has already provided the guided practice.

Independent Practice: The student will have a worksheet for homework.

Assessment: The computer records a score on a set of problems after the student has achieved a seventy percent on a practice set.

Closure: Make sure that the students are understanding how to multiply numbers ending with zeros.
Lesson: #18  Multiplication by Powers of 10

Objective: The students will acquire the knowledge and understanding of adding three digit numbers.

Materials: Computer and the Basic Math Skills Program.

Procedure: The instructor will assign Multiplication by Powers of 10 in the Basic Math Skills Program. The student will be given ten problems to solve. If the student achieves a seventy percent, they then have the opportunity to do another set of problems for a recorded score.

Guided Practice: None. It is assumed that the teacher has already provided the guided practice.

Independent Practice: The student will have a worksheet for homework.

Assessment: The computer records a score on a set of problems after the student has achieved a seventy percent on a practice set.

Closure: Make sure that the students are understanding how to multiply by powers of ten.
<table>
<thead>
<tr>
<th>Lesson: #19</th>
<th><strong>Multiplication by Decimals using Zeros</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Objective:</strong></td>
<td>The students will acquire the knowledge and understanding of adding three digit numbers.</td>
</tr>
<tr>
<td><strong>Materials:</strong></td>
<td>Computer and the Basic Math Skills Program.</td>
</tr>
<tr>
<td><strong>Procedure:</strong></td>
<td>The instructor will assign <strong>Multiplication by Decimals using Zeros</strong> in the Basic Math Skills Program. The student will be given ten problems to solve. If the student achieves a seventy percent, they then have the opportunity to do another set of problems for a recorded score.</td>
</tr>
<tr>
<td><strong>Guided Practice:</strong></td>
<td>None. It is assumed that the teacher has already provided the guided practice.</td>
</tr>
<tr>
<td><strong>Independent Practice:</strong></td>
<td>The student will have a worksheet for homework.</td>
</tr>
<tr>
<td><strong>Assessment:</strong></td>
<td>The computer records a score on a set of problems after the student has achieved a seventy percent on a practice set.</td>
</tr>
<tr>
<td><strong>Closure:</strong></td>
<td>Make sure that the students are understanding how to multiply by decimals using zeros.</td>
</tr>
</tbody>
</table>
Lesson: #20  

Multiplication of fractions

Objective:  The students will acquire the knowledge and understanding of adding three digit numbers.

Materials:  Computer and the Basic Math Skills Program.

Procedure:  The instructor will assign Multiplication of fractions in the Basic Math Skills Program. The student will be given ten problems to solve. If the student achieves a seventy percent, they then have the opportunity to do another set of problems for a recorded score.

Guided Practice: None. It is assumed that the teacher has already provided the guided practice.

Independent Practice: The student will have a worksheet for homework.

Assessment: The computer records a score on a set of problems after the student has achieved a seventy percent on a practice set.

Closure: Make sure that the students are understanding how to multiply fractions.
Lesson: #21 Multiplication of Mixed Number Fractions

Objective: The students will acquire the knowledge and understanding of adding three digit numbers.

Materials: Computer and the Basic Math Skills Program.

Procedure: The instructor will assign Multiplication of Mixed Number Fractions in the Basic Math Skills Program. The student will be given ten problems to solve. If the student achieves a seventy percent, they then have the opportunity to do another set of problems for a recorded score.

Guided Practice: None. It is assumed that the teacher has already provided the guided practice.

Independent Practice: The student will have a worksheet for homework.

Assessment: The computer records a score on a set of problems after the student has achieved a seventy percent on a practice set.

Closure: Make sure that the students are understanding how to multiply fractions with mixed numbers.
Lesson: #22 Percent of Number

Objective: The students will acquire the knowledge and understanding of adding three digit numbers.

Materials: Computer and the Basic Math Skills Program.

Procedure: The instructor will assign Percent of Number in the Basic Math Skills Program. The student will be given ten problems to solve. If the student achieves a seventy percent, they then have the opportunity to do another set of problems for a recorded score.

Guided Practice: None. It is assumed that the teacher has already provided the guided practice.

Independent Practice: The student will have a worksheet for homework.

Assessment: The computer records a score on a set of problems after the student has achieved a seventy percent on a practice set.

Closure: Make sure that the students are understanding how to get the percent of a number.
Lesson: #23  Division of Four Digit Numbers by two Digit Numbers

Objective: The students will acquire the knowledge and understanding of adding three digit numbers.

Materials: Computer and the Basic Math Skills Program.

Procedure: The instructor will assign Division of Four Digit Numbers by two Digit Numbers in the Basic Math Skills Program. The student will be given ten problems to solve. If the student achieves a seventy percent, they then have the opportunity to do another set of problems for a recorded score.

Guided Practice: None. It is assumed that the teacher has already provided the guided practice.

Independent Practice: The student will have a worksheet for homework.

Assessment: The computer records a score on a set of problems after the student has achieved a seventy percent on a practice set.

Closure: Make sure that the students are understanding how to divide four digit numbers by two digit.
numbers.
Lesson: #24 Division Using Zeros

Objective: The students will acquire the knowledge and understanding of adding three digit numbers.

Materials: Computer and the Basic Math Skills Program.

Procedure: The instructor will assign Division Using Zeros in the Basic Math Skills Program. The student will be given ten problems to solve. If the student achieves a seventy percent, they then have the opportunity to do another set of problems for a recorded score.

Guided Practice: None. It is assumed that the teacher has already provided the guided practice.

Independent Practice: The student will have a worksheet for homework.

Assessment: The computer records a score on a set of problems after the student has achieved a seventy percent on a practice set.

Closure: Make sure that the students are understanding how to divide using zeros.
Lesson: #25 Division with Remainders

Objective: The students will acquire the knowledge and understanding of adding three digit numbers.

Materials: Computer and the Basic Math Skills Program.

Procedure: The instructor will assign Division with Remainders in the Basic Math Skills Program. The student will be given ten problems to solve. If the student achieves a seventy percent, they then have the opportunity to do another set of problems for a recorded score.

Guided Practice: None. It is assumed that the teacher has already provided the guided practice.

Independent Practice: The student will have a worksheet for homework.

Assessment: The computer records a score on a set of problems after the student has achieved a seventy percent on a practice set.

Closure: Make sure that the students are understanding how to divide with remainders.
Lesson: #26 Division with 2 and 3 Digit Divisor

Objective: The students will acquire the knowledge and understanding of adding three digit numbers.

Materials: Computer and the Basic Math Skills Program.

Procedure: The instructor will assign Division with 2 and 3 Digit Divisor in the Basic Math Skills Program. The student will be given ten problems to solve. If the student achieves a seventy percent, they then have the opportunity to do another set of problems for a recorded score.

Guided Practice: None. It is assumed that the teacher has already provided the guided practice.

Independent Practice: The student will have a worksheet for homework.

Assessment: The computer records a score on a set of problems after the student has achieved a seventy percent on a practice set.

Closure: Make sure that the students are understanding how to divide using two and three digit divisor.
**Lesson: #27**  

**Objective:** The students will acquire the knowledge and understanding of adding three digit numbers.

**Materials:** Computer and the Basic Math Skills Program.

**Procedure:** The instructor will assign *Division by Decimals* in the Basic Math Skills Program. The student will be given ten problems to solve. If the student achieves a seventy percent, they then have the opportunity to do another set of problems for a recorded score.

**Guided Practice:** None. It is assumed that the teacher has already provided the guided practice.

**Independent Practice:** The student will have a worksheet for homework.

**Assessment:** The computer records a score on a set of problems after the student has achieved a seventy percent on a practice set.

**Closure:** Make sure that the students are understanding how to divide with decimals.
Lesson: #28  Division by Decimals (Tens)

Objective: The students will acquire the knowledge and understanding of adding three digit numbers.

Materials: Computer and the Basic Math Skills Program.

Procedure: The instructor will assign Division by Decimals (Tens) in the Basic Math Skills Program. The student will be given ten problems to solve. If the student achieves a seventy percent, they then have the opportunity to do another set of problems for a recorded score.

Guided Practice: None. It is assumed that the teacher has already provided the guided practice.

Independent Practice: The student will have a worksheet for homework.

Assessment: The computer records a score on a set of problems after the student has achieved a seventy percent on a practice set.

Closure: Make sure that the students are understanding how to divide by decimals (Tens).
Lesson: #29

Objective: Dividing Decimals by Whole Numbers
The students will acquire the knowledge and understanding of adding three digit numbers.

Materials: Computer and the Basic Math Skills Program.

Procedure: The instructor will assign Dividing Decimals by Whole Numbers in the Basic Math Skills Program. The student will be given ten problems to solve. If the student achieves a seventy percent, they then have the opportunity to do another set of problems for a recorded score.

Guided Practice: None. It is assumed that the teacher has already provided the guided practice.

Independent Practice: The student will have a worksheet for homework.

Assessment: The computer records a score on a set of problems after the student has achieved a seventy percent on a practice set.

Closure: Make sure that the students are understanding how to divide decimals with whole numbers.
Lesson: #30  Divisibility by 2, 3, 5, 9, 10

Objective: The students will acquire the knowledge and understanding of adding three digit numbers.

Materials: Computer and the Basic Math Skills Program.

Procedure: The instructor will assign Divisibility by 2, 3, 5, 9, 10 in the Basic Math Skills Program. The student will be given ten problems to solve. If the student achieves a seventy percent, they then have the opportunity to do another set of problems for a recorded score.

Guided Practice: None. It is assumed that the teacher has already provided the guided practice.

Independent Practice: The student will have a worksheet for homework.

Assessment: The computer records a score on a set of problems after the student has achieved a seventy percent on a practice set.

Closure: Make sure that the students are understanding how to divide by 2, 3, 5, 9, 10.
Lesson: #31  Simplifying Fractions

Objective: The students will acquire the knowledge and understanding of adding three digit numbers.

Materials: Computer and the Basic Math Skills Program.

Procedure: The instructor will assign *Simplifying Fractions* in the Basic Math Skills Program. The student will be given ten problems to solve. If the student achieves a seventy percent, they then have the opportunity to do another set of problems for a recorded score.

Guided Practice: None. It is assumed that the teacher has already provided the guided practice.

Independent Practice: The student will have a worksheet for homework.

Assessment: The computer records a score on a set of problems after the student has achieved a seventy percent on a practice set.

Closure: Make sure that the students are understanding how to simplify fractions.
<table>
<thead>
<tr>
<th><strong>Lesson: #32</strong></th>
<th><strong>Comparing Decimals</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Objective:</strong></td>
<td>The students will acquire the knowledge and understanding of adding three digit numbers.</td>
</tr>
<tr>
<td><strong>Materials:</strong></td>
<td>Computer and the Basic Math Skills Program.</td>
</tr>
<tr>
<td><strong>Procedure:</strong></td>
<td>The instructor will assign <strong>Comparing Decimals</strong> in the Basic Math Skills Program. The student will be given ten problems to solve. If the student achieves a seventy percent, they then have the opportunity to do another set of problems for a recorded score.</td>
</tr>
<tr>
<td><strong>Guided Practice:</strong></td>
<td>None. It is assumed that the teacher has already provided the guided practice.</td>
</tr>
<tr>
<td><strong>Independent Practice:</strong></td>
<td>The student will have a worksheet for homework.</td>
</tr>
<tr>
<td><strong>Assessment:</strong></td>
<td>The computer records a score on a set of problems after the student has achieved a seventy percent on a practice set.</td>
</tr>
<tr>
<td><strong>Closure:</strong></td>
<td>Make sure that the students are understanding how to compare decimals.</td>
</tr>
</tbody>
</table>
Lesson: #33 Decimal Place Value

Objective: The students will acquire the knowledge and understanding of adding three digit numbers.

Materials: Computer and the Basic Math Skills Program.

Procedure: The instructor will assign Decimal Place Value in the Basic Math Skills Program. The student will be given ten problems to solve. If the student achieves a seventy percent, they then have the opportunity to do another set of problems for a recorded score.

Guided Practice: None. It is assumed that the teacher has already provided the guided practice.

Independent Practice: The student will have a worksheet for homework.

Assessment: The computer records a score on a set of problems after the student has achieved a seventy percent on a practice set.

Closure: Make sure that the students are understanding decimal place value.
Lesson: #34  Number Place Value

Objective: The students will acquire the knowledge and understanding of adding three digit numbers.

Materials: Computer and the Basic Math Skills Program.

Procedure: The instructor will assign Number Place Value in the Basic Math Skills Program. The student will be given ten problems to solve. If the student achieves a seventy percent, they then have the opportunity to do another set of problems for a recorded score.

Guided Practice: None. It is assumed that the teacher has already provided the guided practice.

Independent Practice: The student will have a worksheet for homework.

Assessment: The computer records a score on a set of problems after the student has achieved a seventy percent on a practice set.

Closure: Make sure that the students are understanding place value.
Lesson: #35  Rounding Numbers

Objective: The students will acquire the knowledge and understanding of adding three digit numbers.

Materials: Computer and the Basic Math Skills Program.

Procedure: The instructor will assign Rounding Numbers in the Basic Math Skills Program. The student will be given ten problems to solve. If the student achieves a seventy percent, they then have the opportunity to do another set of problems for a recorded score.

Guided Practice: None. It is assumed that the teacher has already provided the guided practice.

Independent Practice: The student will have a worksheet for homework.

Assessment: The computer records a score on a set of problems after the student has achieved a seventy percent on a practice set.

Closure: Make sure that the students are understanding how to round numbers.
Lesson: #36  Estimating Differences

Objective: The students will acquire the knowledge and understanding of adding three digit numbers.

Materials: Computer and the Basic Math Skills Program.

Procedure: The instructor will assign Estimating Differences in the Basic Math Skills Program. The student will be given ten problems to solve. If the student achieves a seventy percent, they then have the opportunity to do another set of problems for a recorded score.

Guided Practice: None. It is assumed that the teacher has already provided the guided practice.

Independent Practice: The student will have a worksheet for homework.

Assessment: The computer records a score on a set of problems after the student has achieved a seventy percent on a practice set.

Closure: Make sure that the students are understanding how to estimate differences.
Lesson: #37  

**Estimations of Products**

Objective: The students will acquire the knowledge and understanding of adding three digit numbers.

Materials: Computer and the Basic Math Skills Program.

Procedure: The instructor will assign **Estimations of Products** in the Basic Math Skills Program. The student will be given ten problems to solve. If the student achieves a seventy percent, they then have the opportunity to do another set of problems for a recorded score.

Guided Practice: None. It is assumed that the teacher has already provided the guided practice.

Independent Practice: The student will have a worksheet for homework.

Assessment: The computer records a score on a set of problems after the student has achieved a seventy percent on a practice set.

Closure: Make sure that the students are understanding how to estimate of products.
Lesson: #38  Determining Factors of Numbers

Objective: The students will acquire the knowledge and understanding of adding three digit numbers.

Materials: Computer and the Basic Math Skills Program.

Procedure: The instructor will assign Determining Factors of Numbers in the Basic Math Skills Program. The student will be given ten problems to solve. If the student achieves a seventy percent, they then have the opportunity to do another set of problems for a recorded score.

Guided Practice: None. It is assumed that the teacher has already provided the guided practice.

Independent Practice: The student will have a worksheet for homework.

Assessment: The computer records a score on a set of problems after the student has achieved a seventy percent on a practice set.

Closure: Make sure that the students are understanding how to determine factors of numbers.
**Lesson: #39 Greatest Common Factor (GCF)**

**Objective:** The students will acquire the knowledge and understanding of adding three digit numbers.

**Materials:** Computer and the Basic Math Skills Program.

**Procedure:** The instructor will assign Greatest Common Factor (GCF) in the Basic Math Skills Program. The student will be given ten problems to solve. If the student achieves a seventy percent, they then have the opportunity to do another set of problems for a recorded score.

**Guided Practice:** None. It is assumed that the teacher has already provided the guided practice.

**Independent Practice:** The student will have a worksheet for homework.

**Assessment:** The computer records a score on a set of problems after the student has achieved a seventy percent on a practice set.

**Closure:** Make sure that the students are understanding how to name the greatest common factor of numbers.
Lesson: #40  Least Common Multiple (LCM)

Objective: The students will acquire the knowledge and understanding of adding three digit numbers.

Materials: Computer and the Basic Math Skills Program.

Procedure: The instructor will assign Least Common Multiple (LCM) in the Basic Math Skills Program. The student will be given ten problems to solve. If the student achieves a seventy percent, they then have the opportunity to do another set of problems for a recorded score.

Guided Practice: None. It is assumed that the teacher has already provided the guided practice.

Independent Practice: The student will have a worksheet for homework.

Assessment: The computer records a score on a set of problems after the student has achieved a seventy percent on a practice set.

Closure: Make sure that the students are understanding how to find the least common multiple.
CHAPTER FOUR

Conclusion

This mathematics program has an advantage in that it gives the student, some one on one practice, in the skills that the student needs. Students can work without the pressure and/or embarrassment if he/she gets the wrong answers. It allows the teacher to assign practice in the area that the student needs in remediation. The program records all scores on the beginning screen, for easy observation by the instructor, and student. A running average for all completed assignments is prominently displayed on the beginning screen. All assignments attempted but not completed have a recorded score of "Inc", and remains so until a test has been attempted and scores. Nothing appears next to an assignment until the student has actually elected to do that assignment. This lets the teacher quickly evaluate progress, by noting how many assignments have not been attempted, how many have been attempted, but not completed and how many assignments have been completed. Plus the average for all completed assignments is displayed next to the students name on the first screen.

Program Evaluation

This program will be used in the computer lab specifically for students that are have not mastered the basic skills necessary to pass the School District Algebra Readiness Test. The math teachers can assign any skills area
in which the student needs more practice, either using the computer program or paper and pencil assignments, that exactly correspond to the assignments that are included in the computer program.

This will afford an excellent opportunity to compare results, gathered using both methods, and has the added advantage of providing comparable home work assignments.

Instructors in the computer lab will evaluate progress of students by direct observance of scores recorded by the computer program and paper and pencil assignments. This class is taken concurrently with the students regular mathematics class. It replaces an elective class, and students will remain until they prove their skill in the regular mathematics classes, to which they are assigned.

This program will run for a period of one year, at the end of which, progress will be evaluated, using the School District Mandated Algebra Readiness Test.

All teachers involved in the elective portion of the mathematics program will compare data with the teachers, who have the students in their regular mathematics classes, on a regular basis.

Suggestions from the primary mathematics instructor will be implemented by the Lab instructor on a regular basis. This will allow immediate evaluation in the suggested areas, and allow intervention at each skill level. This should offer an improved model of learning assessment, and an excellent opportunity for teachers to work in a group to establish individualized curriculum, that will meet the need
of the at risk student, in a way not possible in the regular classroom.

Minor revisions and adjustments can be made in the program at regular intervals, major revisions should be implemented only after a full year of data is accumulated. Major revisions to the computer program, would require the original author or a qualified HyperCard programmer, to implement.

Because this program is considered a pilot program and only involves approximately thirty students at any one time, the success or lack success of the program will be immediately observable. Simply comparing improvement in the skills of those students in the program, with students not in the program, who demonstrated approximately the same level of achievement at the beginning of the school year.

Although this program does not directly address the issues of socioeconomics or ethnicity, it would be a simple matter to include those criteria in the evaluation of the program.
APPENDIX A

Program instructions

USING THE PROGRAM

The teacher is presented with the following screen when the Basic Math program is launched. To set up the program for a student, the instructor must hold down the option-key while clicking on the "a" in the word "Math" in the title at the top of the window.

```
Basic Math Skills

Assigned Lessons | Assigned Lessons
-----------------|------------------
Addition of 3 Digit Numbers | Multiplication of Mixed Number Fractions
Addition of Numbers With Three Decimal Places | Percent of a Number
Addition with Mixed Numbers | Division of 4 Digit Numbers by 2 Digit Numbers
Adding Improper Fractions | Division With Remainders
Addition With Like Denominators | Division with 2 & 3 Digit Divisors
Addition With Unlike Denominators | Division by Decimals
Subtraction | Division by Decimals (Ten)
Subtraction With Zeros | Dividing Decimals by Whole Numbers
Subtraction of Numbers With Zeros | Divisibility by 2, 3, 5, 9, 10
Subtraction With Mixed Numbers | Simplifying Fractions
Subtracting Fractions With Unlike Denominators | Completing Decimals
Multiplication by 2 and 3 Digits | Decimal Place Value
Multiplication by Decimals | Rounding Numbers
Multiplying Decimals by Decimals | Estimating Differences
Multiplication of Numbers Ending With Zero | Estimations of Products
Multiplying by Powers of Ten | Determining Factors of Numbers
Multiplying of Decimals Using Zeros | Greatest Common Factor (GCF)
Multiplication of Fractions | Least Common Multiple (LCM)
```

This will present the instructor with a dialog box asking for a password, the default is "teacher", type "teacher" without the quotes into the dialog box and click OK.

```
Enter Password
Teacher

OK Cancel
```

90
This will hide the Title "Basic Math Skills" and reveal a set of buttons, from which the instructor will set all options for the student.

The first step should be to enter a new password for the teacher by clicking on the "change password" button, then enter the new password.

The next step should be to click on the "Enter Student Name" after the name is entered, it will be placed at the bottom of the page, where the default "student name" is now displayed. This also changes the name of the stack to the student name, to make it easy for the student to locate their program.

Next click on the "Restore Defaults" button. This will enable the automatic selection of all assignments, with the option of turning on the calculator during practice sessions only, during tests only, or during both tests and practice sessions. This does not inhibit the instructor from making individual decisions by clicking on each radio button separately. The radio button is on if the center is black, off when the center is white. The assignment buttons are called check boxes and are selected when an X is displayed in the box, not selected when the X is not displayed in the box.

After setting up the assignments for the student, the instructor should click on the "Exit Utilities" button. This will disable all the teacher functions and make the program ready for student use.
The student will always be presented with the same startup screen, from which he may select any assignment the instructor has selected by the check box next to the name of the assignment. The student cannot do any assignment that has not been assigned. Once a student has selected an assignment to work on, a score of "inc" is recorded for that assignment. The "inc" remains until the student has successfully completed a practice session, and taken a test. The Score for the test once completed, will replace the "inc" and the student will no longer be allowed to return to that assignment. As grades are recorded a running average of all test scores will be displayed next to the student name at the bottom of the window. The instructor at anytime will be able to reassign any assignment, to allow the student to make a better grade.

<table>
<thead>
<tr>
<th>Basic Math Skills</th>
</tr>
</thead>
</table>

### Assigned Lessons

<table>
<thead>
<tr>
<th></th>
<th>100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Addition of 3 Digit Numbers</td>
<td>Inc</td>
</tr>
<tr>
<td>Addition of Numbers With Three Decimal Places</td>
<td>100</td>
</tr>
<tr>
<td>Addition with Mixed Numbers</td>
<td>Inc</td>
</tr>
<tr>
<td>Addition With Like Denominators</td>
<td>Inc</td>
</tr>
<tr>
<td>Addition With Unlike Denominators</td>
<td>Inc</td>
</tr>
<tr>
<td>Subtraction</td>
<td>100</td>
</tr>
<tr>
<td>Subtraction With Zero</td>
<td>100</td>
</tr>
<tr>
<td>Subtraction of Decimals</td>
<td>100</td>
</tr>
<tr>
<td>Subtraction With Mixed Numbers</td>
<td>Inc</td>
</tr>
<tr>
<td>Subtracting Fractions With Unlike Denominators</td>
<td>Inc</td>
</tr>
<tr>
<td>Multiplication by 2 and 3 Digits</td>
<td>Inc</td>
</tr>
<tr>
<td>Multiplication by 3 Digit Numbers</td>
<td>Inc</td>
</tr>
<tr>
<td>Multiplication by Decimals</td>
<td>Inc</td>
</tr>
<tr>
<td>Multiplying Decimals by Decimals</td>
<td>Inc</td>
</tr>
<tr>
<td>Multiplication of Numbers Ending With Zero</td>
<td>Inc</td>
</tr>
<tr>
<td>Multiplying by Powers of Ten</td>
<td>Inc</td>
</tr>
<tr>
<td>Multiplication of Decimals Using Zero</td>
<td>Inc</td>
</tr>
<tr>
<td>Multiplication of Fractions</td>
<td>Inc</td>
</tr>
</tbody>
</table>

### Assigned Lessons

|                        |
|------------------------|-----|
| Multiplication of Mixed Number Fractions | Inc |
| Percent of a Number | Inc |
| Division of 4 Digit Numbers by 2 Digit Numbers | Inc |
| Division Using Zero | Inc |
| Division With Remainder | Inc |
| Division with 2 & 3 Digit Divisors | Inc |
| Division by Decimals | Inc |
| Division by Decimals (Tens) | Inc |
| Dividing Decimals by Whole Numbers | Inc |
| Divisibility by 2, 3, 5, 9, 10 | Inc |
| Simplifying Fractions | Inc |
| Comparing Decimals | Inc |
| Decimal Place Value | Inc |
| Number Place Value | Inc |
| Dividing Numbers | Inc |
| Estimating Differences | Inc |
| Estimations of Products | Inc |
| Determining Factors of Numbers | Inc |
| Greatest Common Factor (GCF) | Inc |
| Least Common Multiple (LCM) | Inc |

| Student Name: Average |
|-----------------------|---|
| 92                    |   |
All assignment for the student are presented in the same fashion as the picture below. When the student first selects an assignment, the title of the assignment is displayed in the "title window". The "Practice" button is available, and the "Take Test" button is unavailable.

<table>
<thead>
<tr>
<th>Addition of 3 Three Digit Numbers</th>
<th>Number Correct</th>
<th>Number To Do</th>
<th>Number Wrong</th>
</tr>
</thead>
<tbody>
<tr>
<td>Example</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carry</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>736 736 736 736 736 736 237 237 237 237 772 772 772 772 772 5 45 1745 1745</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Once the "Practice" button has been selected, the problems are generated, the "Practice" button is disabled, and remains so unless the student scores less than seventy percent on the practice session, in which case it will tell the student they should do another practice session, and enable the "Practice" button.
If the student scores seventy percent or better on the practice session, they will be notified of the success and offered the opportunity to take a test for a recorded score. The "Take Test" button will be enabled and the student may choose to take the test then or anytime later, because the assignment will have an incomplete recorded until they actually complete a test for a score.

Once the Take Test button is clicked by the student, the "Take Test" button is disabled and a new message is displayed, "Test in Progress".
The calculator will be disabled if that option has been selected by the instructor. The screen will look like the one below, and will stay that way until the student completes the test for a recorded score, or the instructor reassigns that assignment.

<table>
<thead>
<tr>
<th>Addition of 3 Three Digit Numbers</th>
<th>Number Correct</th>
<th>Number To Do</th>
<th>Number Wrong</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
<td>10</td>
<td>0</td>
</tr>
</tbody>
</table>

![Example of 3 Three Digit Numbers](image)

```
292  129  890
+ 736 736 736 736 736
  237 237 237 237 237
+ 772 772 772 772 772
  5 45 1745 1745
```

Test in Progress

Check Answer

Calculator Disabled

95
## Basic Math Skills

<table>
<thead>
<tr>
<th>Assigned Lessons</th>
<th>Assigned Lessons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Addition of 3 Digit Numbers</td>
<td>Multiplication of Mixed Number Fractions</td>
</tr>
<tr>
<td>Addition of Numbers With Three Decimal Places</td>
<td>Percent of a Number</td>
</tr>
<tr>
<td>Addition with Mixed Numbers</td>
<td>Division of 4 Digit Numbers by 2 Digit Numbers</td>
</tr>
<tr>
<td>Addition With Like Denominators</td>
<td>Division Using Zeros</td>
</tr>
<tr>
<td>Addition With Unlike Denominators</td>
<td>Division, Using Zeros</td>
</tr>
<tr>
<td>Subtraction</td>
<td>Division with Zeros, Remainders</td>
</tr>
<tr>
<td>Subtraction With Zero</td>
<td>Division by Decimals</td>
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<tr>
<td>Subtraction of Decimals</td>
<td>Division by Decimals</td>
</tr>
<tr>
<td>Subtraction of Decimals With Zeros</td>
<td>Division by Decimals, Tenths</td>
</tr>
<tr>
<td>Subtraction With Mixed Numerals</td>
<td>Division by Decimals, Hundredths</td>
</tr>
<tr>
<td>Subtracting Fractions With Unlike Denominators</td>
<td>Division by Decimals, Thousandths</td>
</tr>
<tr>
<td>Multiplication by 2 and 3 Digits</td>
<td>Division by Decimals, Ten</td>
</tr>
<tr>
<td>Multiplication by 3 Digits</td>
<td>Division by Decimals, Hundred</td>
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<tr>
<td>Multiplication by Decimals</td>
<td>Division by Decimals, Thousand</td>
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<tr>
<td>Multiplying Decimals by Decimals</td>
<td>Division by Decimals, Ten Thousand</td>
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<tr>
<td>Multiplying Decimals by Tenths</td>
<td>Division by Decimals, Hundred Thousand</td>
</tr>
<tr>
<td>Multiplication of Decimals Ending With Zero</td>
<td>Division by Decimals, Million</td>
</tr>
<tr>
<td>Multiplying by Powers of Ten</td>
<td>Division by Tenths</td>
</tr>
<tr>
<td>Multiplying by Powers of Ten</td>
<td>Division by Hundredths</td>
</tr>
<tr>
<td>Multiplication of Numbers Ending With Zero</td>
<td>Division by Thousandths</td>
</tr>
<tr>
<td>Multiplication of Decimals Using Zeros</td>
<td>Division by Ten Thousandths</td>
</tr>
<tr>
<td>Multiplication of Fractions</td>
<td>Division by Hundred Thousandths</td>
</tr>
</tbody>
</table>

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### Student Name: Average

<table>
<thead>
<tr>
<th>Reset Defaults</th>
<th>Enter Student Name</th>
<th>Exit Utilities</th>
<th>Change Password</th>
</tr>
</thead>
</table>

- Addition of 3 Digit Numbers
- Addition of Numbers With Three Decimal Places
- Addition with Mixed Numbers
- Addition With Like Denominators
- Addition With Unlike Denominators
- Subtraction
- Subtraction With Zero
- Subtraction of Decimals
- Subtraction of Decimals With Zeros
- Subtraction With Mixed Numerals
- Subtracting Fractions With Unlike Denominators
- Multiplication by 2 and 3 Digits
- Multiplication by 3 Digits
- Multiplication by Decimals
- Multiplying Decimals by Decimals
- Multiplying Decimals by Tenths
- Multiplication of Decimals Ending With Zero
- Multiplying by Powers of Ten
- Multiplication of Numbers Ending With Zero
- Multiplication of Decimals Using Zeros
- Multiplication of Fractions
- Multiplication of Mixed Number Fractions
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- Division Using Zeros
- Division, Using Zeros
- Division with Zeros, Remainders
- Division by Decimals
- Division by Decimals, Tenths
- Division by Decimals, Hundredths
- Division by Decimals, Thousandths
- Division by Decimals, Ten Thousandths
- Division by Decimals, Hundred Thousandths
- Division by Decimals, Thousand Thousandths
- Division by Tenths
- Division by Hundredths
- Division by Thousandths
- Division by Ten Thousandths
- Division by Hundred Thousandths
- Division by Thousand Thousandths
- Estimating Differences
- Estimations of Products
- Determining Factors of Numbers
- Greatest Common Factor (GCF)
- Least Common Multiple (LCM)
Always add in each place-value position from the least to the greatest.
To add decimals, align the decimal points. Then add as with whole numbers.
When adding mixed numbers, rename the fractions with like denominators. Add the whole numbers and then add the numerators. Divide the numerator by the denominator, add the whole number that you get to the other whole number. The remainder is the numerator.
When adding or subtracting fractions, you must find a common denominator. You can rarely solve these problems correctly by dividing \((a/b) + (c/d)\), this usually produces a decimal that is not a correct answer.

Add the numerators then divide the numerator by the denominator. The answer becomes the whole number and the remainder is the numerator.
Add the numerators and write the sum over the denominator. The denominator remains the same.
When adding fractions with unlike denominators, you must first find a common denominator. Then add the fractions.

First rename the fractions with the same denominator, then add. Add the whole numbers, then add the numerators.
Subtract in each place-value position from least to greatest.
Sometimes you must rename in more than one place-value position in order to subtract in a particular place-value position.
When subtracting decimal numbers, you must align the decimals before doing the subtraction.

Example:

\[
8052.853 - 2521.110 = \]

To subtract decimals, align the decimal points. Then subtract as with whole numbers.
In order to align decimal points and rename numbers, it is helpful to annex zeros.

example: \[ 20.00 - 6.89 = 13.11 \]

Subtract the tenths, ones, and tens.
When subtracting with mixed numerals, sometimes you must rename before subtracting.
First rename the fractions with the same denominator, then subtract.
Multiply by the number in each place-value position as shown in the example above.
To Multiply a number by a decimal just multiply the number as usual then move the decimal place to the left as many places as there are in the problem. In this example you would move the decimal 3 places to the left.

When you multiply a whole number and a decimal, the product has the same number of decimal places as the decimal.
When you multiply a decimal by a decimal, the number of decimal places in the product is the same as the sum of the number of decimal places in the factors. Multiply as with whole numbers. Then, place the decimal point.
Example:

```
1234
x 370
---
 0000
 8638
+3702
456580
```

Be sure to look at the example above.
Multiplying by 10, 100, 1,000 or so on is easy. When multiplying by 10, just add one zero to your number. When multiplying by 100, just add two zeros to your number, and so on.
It is often necessary to write extra zeros in order to correctly place the decimal point in the product. Multiply as you would a whole number. The answer should have as many decimal places and the factors.
To multiply a fraction and a whole number, rename the whole number as a fraction. Multiply the numerators, then, multiply the denominators.
To multiply with mixed numerals, first rename the mixed numerals as fractions. Then, multiply the fractions.
### Percent of a Number

<table>
<thead>
<tr>
<th>Basenumber</th>
<th>Rate</th>
<th>The Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>146</td>
<td>x</td>
<td>119 %</td>
</tr>
</tbody>
</table>

**Basenumber Rate The Number**

- **Round to:** 129
- **Nearest 2 Decimals:** 30%
- **This can be entered into the calculator as...**
  - $(129 \times 30)/100 = 38.7$ or
  - $129 \times 30\% = 38.7$

---

Percent means per one hundred or hundredths.

To change a decimal to a percent, multiply the decimal by 100, then place the % symbol.

To change a percent to a decimal, divide the percent by 100. Omit the % symbol.
Estimate the tens, multiply and subtract, estimate the ones, multiply and subtract.
Divide in each place-value position even if the quotient there is zero.
In division, sometimes a remainder will result. A remainder can be written as a fraction in simplest form.
Estimate the tens, multiply and subtract, estimate the ones, multiply and subtract.
Division by Decimals

<table>
<thead>
<tr>
<th>Number Correct</th>
<th>Number To Do</th>
<th>Number Wrong</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>10</td>
<td>0</td>
</tr>
</tbody>
</table>

Practice
Take Test
Check Answer

When dividing whole numbers by decimals, you must move the decimal in the divisor to the right until the divisor is a whole number. You must then move the decimal in the dividend the same number of places.

.36 / 6820

Round all answers to 2 decimal places. Example 3.006 = 3.01

Follow the example above.
To divide by a decimal, multiply both the divisor and dividend by the same power of 10 so the divisor is a whole number. Then divide as with whole numbers.
To divide a decimal by a whole number, place the decimal point in the quotient right above where it is in the dividend.
### Divisibility by 2, 3, 5, 9, 10

<table>
<thead>
<tr>
<th>Number</th>
<th>Correct</th>
<th>To Do</th>
<th>Wrong</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>10</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Practice</th>
<th>Take Test</th>
<th>Check Answer</th>
</tr>
</thead>
</table>

2: A number is divisible by 2 if the ones digit is 0, 2, 4, 6, or 8.
3: A number is divisible by 3 if the sum of the digits is 3, 6, 9, 12, 15 or 18.
5: A number is divisible by if the ones digit is 5 or 0.
9: A number is divisible by 9 if the sum of all the digits is 9, or a power of 9.
10: A number is divisible by 10 if it ends with a Zero.

Use the rules above to determine whether a number is divisible by 2, 3, 5, 9, and 10. If a number is divisible by a second number, the second number is a factor of the first.
To change a fraction to simplest form, divide both the numerator and denominator by their GCF.

To simplify the fraction $\frac{12}{24}$:

\[
\frac{12 \div 2}{24 \div 2} = \frac{6}{12} = \frac{3}{6} = \frac{1}{2}
\]
<table>
<thead>
<tr>
<th>Comparing Decimals</th>
<th>Number Correct</th>
<th>Number To Do</th>
<th>Number Wrong</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
<td>10</td>
<td>0</td>
</tr>
</tbody>
</table>

Decide which number is larger, then click the mouse on that number. If you think it is correct then, click the "Check Answer" Button.

You can remove zeros from the right of a decimal without changing its value. Example: 0.100 = 0.1
Decimals use powers of ten such as 10, 100, or 1,000 as denominators.

Example: 0.5 = 5/10  
0.24 = 24/100
Use the chart above to help you solve the problems.
In the one above, you want to round to the nearest thousand. The 6 is in the thousand place, look at the hundreds place, if it is 5 or larger, then the (6) thousands place would go up by one (7) and all digits to the right of it would turn to zeros. The digits to the left would stay the same.
### Estimating Differences

<table>
<thead>
<tr>
<th>Practice</th>
<th>Take Test</th>
<th>Check Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>10</td>
<td>0</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Number Correct</th>
<th>Number To Do</th>
<th>Number Wrong</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>10</td>
<td>0</td>
</tr>
</tbody>
</table>

#### Estimate the difference to the nearest number:

- **9843**
- **9257**

#### When estimating a difference, first determine what place value of accuracy is being asked for. 10's 100's, 1000's...

**Example:**

- To the nearest thousand.

- Fix 3

Round to the nearest thousand then subtract.

Round to the nearest hundred then subtract.

Or round to the nearest ten then subtract.

---

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To estimate a product, round each factor to its greatest place-value position, then multiply.
The factors of a number are the numbers by which it can be divided evenly. That is the remainder is zero upon division.
The Greatest Common Factor (GCF) is the product of the common factors. Prime factors can be used to find the GCF of two numbers.
The least common multiple of two numbers can be found by finding the multiples of each number.

You can also find the LCM by Prime Factorization.

You can find the least common multiples of two numbers by listing the multiples of each.

Multiples of 8: 8, 16, 24, 32, 40 and so forth

Multiples of 12: 12, 24, 36 and so forth
APPENDIX C
Worksheets

Addition using three digits

Find the sums.

1. 456 2. 863 3. 163 4. 482
   + 378 + 593 + 895 + 915
5. 739 6. 927
   + 784 + 157
7. 396 8. 937
   + 338 + 684
9. 774 10. 470 11. 734 12. 485
   456 243 362 364
   + 943 + 783 + 917 + 252
    784 392 784 327
    632 607 632 958
    + 378 + 248 + 777 + 582
17. 575 18. 437 19. 753 20. 873
    482 476 959 127
    836 975 245 753
    + 873 + 278 + 747 + 246
Adding with decimals places

Find the sums.

1. 36.059  
   + 14.128  
   50.187

2. 8.724  
   + 9.656  
   18.380

3. 0.795  
   + 0.818  
   1.613

4. 1.269  
   + 3.756  
   5.025

5. 0.725  
   + 0.548  
   1.273

6. 8.867  
   + 5.327  
   14.194

7. 6.095  
   + 12.763  
   18.858

8. 9.418  
   + 3.766  
   13.184

9. 12.435  
   + 18.741  
   31.176

10. 9.678  
    + 4.866  
    14.544

11. 0.376  
    + 0.469  
    0.845

12. 8.082  
    + 5.643  
    13.725

13. 0.815  
    + 0.659  
    1.474

14. 7.728  
    + 3.236  
    10.964

15. 8.382  
    + 7.654  
    16.036

16. 0.119  
    + 0.087  
    0.206

17. 1.856  
    + 3.727  
    5.583

18. 8.069  
    + 6.167  
    14.236

19. 23.534  
    + 44.612  
    68.146

20. 0.255  
    + 0.512  
    0.767
Adding fractions with mixed numbers

Find the sums.

1. \[ 2 \frac{1}{2} + 3 \frac{3}{4} \]
2. \[ 6 \frac{5}{8} + 9 \frac{1}{2} \]
3. \[ 8 \frac{2}{3} + 11 \frac{1}{4} \]
4. \[ 7 \frac{4}{5} + 3 \frac{1}{2} \]

5. \[ 12 \frac{7}{10} + 15 \frac{9}{10} \]
6. \[ 26 \frac{5}{8} + 32 \frac{1}{4} \]
7. \[ 57 \frac{2}{3} + 48 \frac{2}{3} \]
8. \[ 17 \frac{3}{4} + 25 \frac{1}{3} \]

9. \[ 3 \frac{1}{6} + 7 \frac{3}{4} \]
10. \[ 15 \frac{3}{4} + 19 \frac{27}{100} \]
11. \[ 87 \frac{1}{2} + 12 \frac{1}{2} \]
12. \[ 93 \frac{5}{6} + 66 \frac{2}{3} \]

13. \[ 66 \frac{7}{10} + 29 \frac{3}{5} \]
14. \[ 56 \frac{1}{3} + 23 \frac{1}{8} \]
15. \[ 28 \frac{4}{5} + 49 \frac{3}{4} \]
16. \[ 18 \frac{3}{8} + 36 \frac{1}{5} \]

17. \[ 3 \frac{1}{8} + 8 \frac{3}{4} + 9 \frac{5}{6} \]
18. \[ 12 \frac{1}{6} + 2 \frac{2}{3} + 10 \frac{3}{4} \]
19. \[ 15 \frac{1}{2} + 3 \frac{3}{4} + 13 \frac{2}{3} \]
20. \[ 7 \frac{2}{3} + 5 \frac{1}{3} + 3 \frac{3}{4} \]
Adding improper fractions

Find the sums.

1. \( \frac{10}{6} + \frac{4}{3} = \)  
2. \( \frac{8}{3} + \frac{7}{2} = \)  
3. \( \frac{9}{5} + \frac{12}{10} = \)  
4. \( \frac{5}{3} + \frac{8}{3} = \)  

5. \( \frac{9}{5} + \frac{7}{5} = \)  
6. \( \frac{4}{2} + \frac{6}{2} = \)  
7. \( \frac{9}{6} + \frac{4}{3} = \)  
8. \( \frac{10}{7} + \frac{8}{3} = \)  

9. \( \frac{7}{3} + \frac{8}{3} = \)  
10. \( \frac{7}{6} + \frac{8}{2} = \)  
11. \( \frac{6}{4} + \frac{4}{2} = \)  
12. \( \frac{7}{5} + \frac{5}{3} = \)  

13. \( \frac{6}{4} + \frac{7}{3} = \)  
14. \( \frac{9}{6} + \frac{5}{3} = \)  
15. \( \frac{12}{6} + \frac{10}{3} = \)  
16. \( \frac{15}{6} + \frac{4}{3} = \)  

17. \( \frac{7}{4} + \frac{9}{2} = \)  
18. \( \frac{11}{6} + \frac{12}{3} = \)  
19. \( \frac{14}{5} + \frac{13}{3} = \)  
20. \( \frac{8}{4} + \frac{9}{3} = \)
Adding fractions with like denominators

Find the sums.

1. \( \frac{6}{3} + \frac{4}{3} \)
   \( \frac{10}{3} \)

2. \( \frac{2}{4} + \frac{3}{4} \)
   \( \frac{5}{4} \)

3. \( \frac{5}{8} + \frac{7}{8} \)
   \( \frac{12}{8} \)

4. \( \frac{5}{12} + \frac{7}{12} \)
   \( \frac{12}{12} \)

5. \( \frac{3}{16} + \frac{5}{16} \)
   \( \frac{8}{16} \)

6. \( \frac{3}{8} + \frac{1}{8} \)
   \( \frac{4}{8} \)

7. \( \frac{3}{4} + \frac{2}{4} \)
   \( \frac{5}{4} \)

8. \( \frac{7}{9} + \frac{5}{9} \)
   \( \frac{12}{9} \)

9. \( \frac{3}{10} + \frac{5}{10} \)
   \( \frac{8}{10} \)

10. \( \frac{2}{15} + \frac{7}{15} \)
    \( \frac{9}{15} \)

11. \( \frac{7}{9} + \frac{4}{9} \)
    \( \frac{11}{9} \)

12. \( \frac{3}{5} + \frac{2}{5} \)
    \( \frac{5}{5} \)

13. \( \frac{6}{11} + \frac{7}{11} \)
    \( \frac{13}{11} \)

14. \( \frac{9}{13} + \frac{5}{13} \)
    \( \frac{14}{13} \)

15. \( \frac{12}{25} + \frac{10}{25} \)
    \( \frac{22}{25} \)

16. \( \frac{15}{16} + \frac{14}{16} \)
    \( \frac{29}{16} \)

17. \( \frac{17}{24} + \frac{19}{24} \)
    \( \frac{36}{24} \)

18. \( \frac{11}{16} + \frac{12}{16} \)
    \( \frac{23}{16} \)

19. \( \frac{14}{25} + \frac{13}{25} \)
    \( \frac{27}{25} \)

20. \( \frac{8}{14} + \frac{9}{14} \)
    \( \frac{17}{14} \)
Adding fractions with unlike denominators

Find the sums.

1. \( \frac{2}{3} + \frac{3}{4} \)

2. \( \frac{2}{5} + \frac{3}{4} \)

3. \( \frac{5}{8} + \frac{7}{12} \)

4. \( \frac{5}{12} + \frac{7}{10} \)

5. \( \frac{3}{16} + \frac{5}{8} \)

6. \( \frac{3}{8} + \frac{1}{4} \)

7. \( \frac{3}{4} + \frac{3}{8} \)

8. \( \frac{7}{9} + \frac{5}{18} \)

9. \( \frac{3}{10} + \frac{5}{6} \)

10. \( \frac{2}{3} + \frac{7}{15} \)

11. \( \frac{4}{6} + \frac{7}{9} \)

12. \( \frac{3}{5} + \frac{2}{7} \)

13. \( \frac{6}{7} + \frac{7}{10} \)

14. \( \frac{9}{13} + \frac{5}{10} \)

15. \( \frac{6}{7} + \frac{2}{3} \)

16. \( \frac{5}{6} + \frac{4}{5} \)

17. \( \frac{7}{8} + \frac{5}{24} \)

18. \( \frac{3}{8} + \frac{5}{16} \)

19. \( \frac{4}{5} + \frac{3}{25} \)

20. \( \frac{8}{14} + \frac{5}{7} \)
Subtraction

Find the differences.

1. 215
   - 146
   69

2. 352
   - 176
   176

3. 816
   - 379
   437

4. 933
   - 636
   297

5. 425
   - 157
   268

6. 1744
   - 853
   891

7. 5353
   - 2771
   2582

8. 6811
   - 5733
   1078

9. 9333
   - 1745
   7588

10. 6431
    - 4985
    1446

11. 8374
    - 2865
    5509

12. 9262
    - 5738
    3524

13. 6419
    - 5722
    697

14. 9176
    - 8355
    821

15. 9118
    - 5275
    3843

16. 7523
    - 6649
    874

17. 127429
    - 92668
    34761

18. 43214
    - 29537
    13677

19. 763118
    - 439253
    323865

20. 26319
    - 15721
    10598
### Subtraction with Zeros

Find the differences.

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>107</td>
<td>2.</td>
<td>420</td>
<td>3.</td>
</tr>
<tr>
<td></td>
<td>- 33</td>
<td></td>
<td>- 138</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>800</td>
<td>6.</td>
<td>2630</td>
<td>7.</td>
</tr>
<tr>
<td></td>
<td>- 176</td>
<td></td>
<td>- 1826</td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td>8050</td>
<td>10.</td>
<td>5000</td>
<td>11.</td>
</tr>
<tr>
<td></td>
<td>- 7966</td>
<td></td>
<td>- 2774</td>
<td></td>
</tr>
<tr>
<td>13.</td>
<td>82705</td>
<td>14.</td>
<td>79081</td>
<td>15.</td>
</tr>
<tr>
<td></td>
<td>- 56646</td>
<td></td>
<td>- 36526</td>
<td></td>
</tr>
<tr>
<td>17.</td>
<td>30000</td>
<td>18.</td>
<td>90000</td>
<td>19.</td>
</tr>
<tr>
<td></td>
<td>- 27138</td>
<td></td>
<td>- 56843</td>
<td></td>
</tr>
</tbody>
</table>
Subtraction with Decimals

Find the differences.

1. \(9.3 - 6.5\)
2. \(0.95 - 0.27\)
3. \(1.377 - 0.984\)
4. \(0.74 - 0.27\)
5. \(8.61 - 3.27\)
6. \(52.6 - 24.7\)
7. \(0.525 - 0.139\)
8. \(12.36 - 8.75\)
9. \(2.718 - 0.884\)
10. \(69.49 - 39.69\)
11. \(9.216 - 3.442\)
12. \(57.19 - 19.88\)
13. \(9.132 - 5.193\)
14. \(5.842 - 1.755\)
15. \(0.712 - 0.286\)
16. \(38.515 - 37.828\)
17. \(0.926 - 0.189\)
18. \(824.16 - 392.38\)
19. \(96.28 - 63.37\)
20. \(4.256 - 3.898\)
**Subtraction with Decimals**

Find the differences.

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
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<tr>
<td></td>
<td>- 612.75</td>
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<td>- 33.678</td>
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</table>
Subtracting fractions with mixed numbers

Find the difference.

1. \[ 6 \frac{1}{2} - 2 \frac{3}{4} = \_ \]
2. \[ 6 \frac{1}{4} - 1 \frac{1}{2} = \_ \]
3. \[ 9 \frac{1}{5} - 3 \frac{1}{3} = \_ \]
4. \[ 12 \frac{1}{8} - 7 \frac{3}{4} = \_ \]

5. \[ 33 - 27 \frac{1}{2} = \_ \]
6. \[ 42 \frac{1}{2} - 29 \frac{4}{5} = \_ \]
7. \[ 15 \frac{1}{2} - 3 \frac{3}{4} = \_ \]
8. \[ 73 \frac{3}{10} - 66 \frac{9}{10} = \_ \]

9. \[ 33 \frac{1}{3} - 22 \frac{5}{6} = \_ \]
10. \[ 37 \frac{1}{2} - 29 \frac{9}{10} = \_ \]
11. \[ 8 \frac{1}{5} - 3 \frac{9}{10} = \_ \]
12. \[ 6 \frac{2}{3} - 4 \frac{5}{6} = \_ \]

13. \[ 7 \frac{1}{6} - 3 \frac{2}{3} = \_ \]
14. \[ 26 \frac{3}{4} - 13 \frac{7}{8} = \_ \]
15. \[ 39 \frac{2}{3} - 16 \frac{7}{8} = \_ \]
16. \[ 227 \frac{3}{8} - 194 \frac{1}{5} = \_ \]

17. \[ 41 \frac{2}{5} - 28 \frac{7}{10} = \_ \]
18. \[ 12 \frac{1}{6} - 2 \frac{2}{3} = \_ \]
19. \[ 18 \frac{2}{5} - 12 \frac{3}{4} = \_ \]
20. \[ 333 \frac{2}{3} - 251 \frac{3}{4} = \_ \]
Subtracting fractions with unlike denominators

Find the differences.

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<table>
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<td>[ \frac{2}{3} ]</td>
<td>-</td>
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<tr>
<td>2.</td>
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<td>3.</td>
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<td>-</td>
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<td>4.</td>
<td>[ \frac{7}{8} ]</td>
<td>-</td>
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<td>5.</td>
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<td>-</td>
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<tr>
<td>6.</td>
<td>[ \frac{3}{5} ]</td>
<td>-</td>
<td>[ \frac{1}{4} ]</td>
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<tr>
<td>7.</td>
<td>[ \frac{13}{16} ]</td>
<td>-</td>
<td>[ \frac{3}{8} ]</td>
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<td>8.</td>
<td>[ \frac{4}{5} ]</td>
<td>-</td>
<td>[ \frac{1}{3} ]</td>
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<tr>
<td>9.</td>
<td>[ \frac{5}{6} ]</td>
<td>-</td>
<td>[ \frac{3}{4} ]</td>
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<tr>
<td>10.</td>
<td>[ \frac{2}{3} ]</td>
<td>-</td>
<td>[ \frac{8}{9} ]</td>
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<tr>
<td>11.</td>
<td>[ \frac{5}{8} ]</td>
<td>-</td>
<td>[ \frac{3}{10} ]</td>
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<tr>
<td>12.</td>
<td>[ \frac{1}{3} ]</td>
<td>-</td>
<td>[ \frac{3}{10} ]</td>
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<tr>
<td>13.</td>
<td>[ \frac{15}{16} ]</td>
<td>-</td>
<td>[ \frac{1}{4} ]</td>
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<tr>
<td>14.</td>
<td>[ \frac{2}{3} ]</td>
<td>-</td>
<td>[ \frac{2}{5} ]</td>
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<tr>
<td>15.</td>
<td>[ \frac{3}{10} ]</td>
<td>-</td>
<td>[ \frac{1}{4} ]</td>
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<tr>
<td>16.</td>
<td>[ \frac{4}{5} ]</td>
<td>-</td>
<td>[ \frac{3}{8} ]</td>
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<tr>
<td>17.</td>
<td>[ \frac{5}{6} ]</td>
<td>-</td>
<td>[ \frac{3}{8} ]</td>
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<tr>
<td>18.</td>
<td>[ \frac{4}{5} ]</td>
<td>-</td>
<td>[ \frac{3}{4} ]</td>
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<tr>
<td>19.</td>
<td>[ \frac{9}{10} ]</td>
<td>-</td>
<td>[ \frac{3}{5} ]</td>
<td></td>
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<tr>
<td>20.</td>
<td>[ \frac{1}{2} ]</td>
<td>-</td>
<td>[ \frac{3}{8} ]</td>
<td></td>
</tr>
</tbody>
</table>
Multiplication by 2 digits

Find the products.

1. \(48 \times 32\) 
2. \(73 \times 19\) 
3. \(82 \times 26\) 
4. \(57 \times 41\) 
5. \(124 \times 84\) 
6. \(216 \times 35\) 
7. \(427 \times 74\) 
8. \(666 \times 93\) 
9. \(698 \times 32\) 
10. \(571 \times 63\) 
11. \(250 \times 78\) 
12. \(904 \times 42\) 
13. \(1276 \times 61\) 
14. \(2078 \times 43\) 
15. \(1196 \times 57\) 
16. \(4289 \times 79\) 
17. \(4219 \times 38\) 
18. \(1672 \times 55\) 
19. \(6671 \times 47\) 
20. \(2727 \times 35\)
Multiplication by 3 digits

Find the products.

1. \[318 \times 264\]  
2. \[297 \times 312\]  
3. \[695 \times 138\]  
4. \[515 \times 444\]  

5. \[263 \times 147\]  
6. \[148 \times 379\]  
7. \[622 \times 175\]  
8. \[394 \times 266\]  

9. \[824 \times 243\]  
10. \[771 \times 177\]  
11. \[592 \times 316\]  
12. \[125 \times 119\]  

13. \[843 \times 207\]  
14. \[309 \times 305\]  
15. \[147 \times 650\]  
16. \[844 \times 279\]  

17. \[85,064 \times 226\]  
18. \[42,914 \times 716\]  
19. \[7,891 \times 729\]  
20. \[5,221 \times 974\]
Multiplication by decimals

Find the products.

1. \(607 \times 3.5\)  
2. \(809 \times 5.7\)  
3. \(428 \times 0.9\)  
4. \(125 \times 7.4\)

5. \(263 \times 1.7\)  
6. \(148 \times 3.9\)  
7. \(622 \times 1.5\)  
8. \(394 \times 2.6\)

9. \(914 \times 2.7\)  
10. \(128 \times 3.5\)  
11. \(512 \times 7.6\)  
12. \(912 \times 6.8\)

13. \(1843 \times 2.07\)  
14. \(1309 \times 3.05\)  
15. \(2147 \times 6.50\)  
16. \(1844 \times 2.79\)

17. \(1278 \times 9.4\)  
18. \(629 \times 2.5\)  
19. \(1379 \times 1.01\)  
20. \(5432 \times 4.28\)
### Multiplying Decimals by Decimals

Find the products.

<p>| | | | |</p>
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<thead>
<tr>
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<tbody>
<tr>
<td>1.</td>
<td>0.2</td>
<td>2.</td>
<td>0.12</td>
</tr>
<tr>
<td></td>
<td>x 0.4</td>
<td></td>
<td>x 0.5</td>
</tr>
<tr>
<td>3.</td>
<td>0.23</td>
<td>4.</td>
<td>1.09</td>
</tr>
<tr>
<td></td>
<td>x 0.07</td>
<td></td>
<td>x 0.07</td>
</tr>
</tbody>
</table>

| 5. | 0.18 | 6. | 0.026 |
|   | x 0.3 |   | x 0.009 |
| 7. | 622 | 8. | 3.2 |
|   | x 1.5 |   | x 0.08 |

| 9. | 0.23 |
| x 0.15 |

| 10. | 0.471 |
| x 0.016 |

| 11. | 3.35 |
| x 0.026 |

| 12. | 6.8 |
| x 0.007 |

| 13. | 0.018 |
| x 0.73 |

| 14. | 0.981 |
| x 0.065 |

| 15. | 0.418 |
| x 0.025 |

| 16. | 0.555 |
| x 0.003 |

| 17. | 0.062 |
| x 0.087 |

| 18. | 7.039 |
| x 0.005 |

| 19. | 0.061 |
| x 0.032 |

| 20. | 0.054 |
| x 0.05 |
Multiplication by 2 digits

Find the products.

1. \(38 \times 30\)
2. \(63 \times 10\)
3. \(81 \times 20\)
4. \(47 \times 40\)

5. \(134 \times 80\)
6. \(116 \times 30\)
7. \(327 \times 70\)
8. \(676 \times 90\)

9. \(698 \times 30\)
10. \(571 \times 60\)
11. \(250 \times 70\)
12. \(904 \times 40\)

13. \(1276 \times 610\)
14. \(2078 \times 430\)
15. \(1196 \times 570\)
16. \(4289 \times 790\)

17. \(4219 \times 300\)
18. \(1672 \times 500\)
19. \(6671 \times 400\)
20. \(2727 \times 300\)
Multiplication by powers of 10

Find the products.

1. $70 \times 60 = \underline{\hspace{2cm}}$
2. $12 \times 10 = \underline{\hspace{2cm}}$

3. $404 \times 100 = \underline{\hspace{2cm}}$
4. $9 \times 100 = \underline{\hspace{2cm}}$

5. $4 \times 1000 = \underline{\hspace{2cm}}$
6. $23 \times 100 = \underline{\hspace{2cm}}$

7. $7 \times 1000 = \underline{\hspace{2cm}}$
8. $10 \times 10 = \underline{\hspace{2cm}}$

9. $46 \times 100 = \underline{\hspace{2cm}}$
10. $15 \times 1000 = \underline{\hspace{2cm}}$

11. $53 \times 10 = \underline{\hspace{2cm}}$
12. $40 \times 400 = \underline{\hspace{2cm}}$

13. $9 \times 500 = \underline{\hspace{2cm}}$
14. $8 \times 400 = \underline{\hspace{2cm}}$

15. $3 \times 4000 = \underline{\hspace{2cm}}$
16. $7 \times 3000 = \underline{\hspace{2cm}}$

17. $8 \times 5000 = \underline{\hspace{2cm}}$
18. $50 \times 70 = \underline{\hspace{2cm}}$

19. $30 \times 300 = \underline{\hspace{2cm}}$
20. $60 \times 80 = \underline{\hspace{2cm}}$

Name____________________
Multiplication of decimals using zeros

Find the products.

1. \(10 \times 9.8 = \) _____
2. \(100 \times 6.214 = \) _____

3. \(100 \times 0.07 = \) _____  
4. \(100 \times 54.48 = \) _____

5. \(10 \times 3.09 = \) _____  
6. \(100 \times 0.078 = \) _____

7. \(10 \times 0.74 = \) _____  
8. \(10 \times 0.146 = \) _____

9. \(10 \times 0.563 = \) _____  
10. \(100 \times 0.002 = \) _____

11. \(10 \times 0.1096 = \) _____  
12. \(1000 \times 0.915 = \) _____

13. \(100 \times 0.18 = \) _____  
14. \(10 \times 35.02 = \) _____

15. \(100 \times 0.465 = \) _____  
16. \(1000 \times 6.83 = \) _____

17. \(8 \times 5000 = \) _____  
18. \(100 \times 18.355 = \) _____

19. \(1000 \times 0.004 = \) _____  
20. \(10 \times 28.9 = \) _____
Multiplication of Fractions

Find the products

1. \( \frac{2}{3} \times \frac{1}{4} = \) 

2. \( \frac{3}{8} \times \frac{1}{2} = \)

3. \( \frac{3}{5} \times \frac{2}{3} = \)

4. \( \frac{3}{10} \times \frac{2}{3} = \)

5. \( \frac{3}{4} \times \frac{3}{4} = \)

6. \( \frac{2}{9} \times \frac{3}{4} = \)

7. \( \frac{3}{4} \times \frac{2}{3} = \)

8. \( \frac{7}{10} \times \frac{2}{3} = \)

9. \( \frac{4}{5} \times \frac{5}{6} = \)

10. \( \frac{5}{8} \times \frac{5}{2} = \)

11. \( \frac{3}{10} \times \frac{5}{6} = \)

12. \( \frac{5}{8} \times \frac{8}{5} = \)

13. \( \frac{9}{10} \times \frac{2}{3} = \)

14. \( \frac{1}{6} \times \frac{1}{4} = \)

15. \( \frac{12}{3} \times \frac{1}{2} = \)

16. \( \frac{1}{4} \times \frac{8}{3} = \)

17. \( \frac{7}{10} \times \frac{10}{7} = \)

18. \( \frac{2}{5} \times \frac{5}{8} = \)

19. \( \frac{1}{6} \times \frac{3}{8} = \)

20. \( \frac{3}{5} \times \frac{4}{3} = \)
Multiplication of Mixed Number Fractions

Find the products.

1. \( \frac{1}{3} \times 2 \frac{1}{2} = \) 

2. \( 2 \frac{1}{2} \times 3 \frac{3}{4} = \)

3. \( 3 \frac{1}{2} \times 5 \frac{2}{5} = \)

4. \( 5 \frac{1}{2} \times 1 \frac{3}{4} = \)

5. \( 4 \times 3 \frac{1}{4} = \)

6. \( 4 \frac{1}{2} \times 5 \frac{2}{3} = \)

7. \( 8 \times 13 \frac{1}{2} = \)

8. \( 12 \times 4 \frac{2}{3} = \)

9. \( 10 \times 2 \frac{4}{5} = \)

10. \( 4 \frac{9}{10} \times 36 = \)

11. \( 2 \frac{1}{2} \times 3 \frac{3}{4} = \)

12. \( 2 \frac{1}{2} \times 3 \frac{3}{4} = \)

13. \( 1 \frac{2}{3} \times 6 = \)

14. \( \frac{3}{4} \times 12 \frac{1}{2} = \)

15. \( 1 \frac{1}{2} \times 1 \frac{1}{2} = \)

16. \( 2 \frac{3}{4} \times 2 = \)

17. \( 2 \frac{1}{4} \times 3 \frac{3}{5} = \)

18. \( 5 \frac{1}{3} \times 2 \frac{1}{4} = \)

19. \( 4 \frac{4}{5} \times 3 \frac{1}{3} = \)

20. \( 6 \frac{1}{2} \times \frac{1}{3} = \)
Write the percent of the number.

1. 6% of 900 ________ 2. 30% of 70 ________
3. 150% of 17 ________ 4. 325% of 4 ________
5. 12% of 50 ________ 6. 0.5% of 98 ________
7. 20% of 16 ________ 8. 75% of 4,004 ________
9. 225% of 50 ________ 10. 22% of 100 ________
11. 88% of 10 ________ 12. 17.5% of 20 ________
13. 3.5% of 600 ________ 14. 100% of 17 ________
15. 15% of 120 ________ 16. 1% of 5 ________
17. 1% of 1 ________ 18. 6% of 120 ________
19. 25% of 1,300 ________ 20. 50% of 8 ________
Division of four digit numbers by two digit numbers.

Divide

1. $81 \div 4287$
2. $94 \div 6394$
3. $24 \div 1819$
4. $72 \div 1664$

5. $43 \div 3225$
6. $21 \div 1696$
7. $95 \div 8793$
8. $64 \div 4800$

9. $32 \div 2243$
10. $83 \div 1691$
11. $52 \div 1898$
12. $75 \div 5324$

13. $36 \div 1404$
14. $54 \div 2750$
15. $27 \div 6478$
16. $78 \div 1519$

17. $59 \div 1542$
18. $92 \div 5244$
19. $45 \div 4293$
20. $73 \div 4951$
Division using Zeros

Divide

1. $50 \div 300$
2. $70 \div 350$
3. $50 \div 150$
4. $90 \div 540$

5. $30 \div 210$
6. $60 \div 540$
7. $90 \div 3600$
8. $80 \div 2400$

9. $50 \div 2500$
10. $60 \div 1800$
11. $40 \div 1200$
12. $30 \div 1800$

13. $20 \div 1600$
14. $70 \div 4200$
15. $60 \div 2400$
16. $80 \div 40000$

17. $90 \div 45000$
18. $50 \div 20000$
19. $60 \div 36000$
20. $30 \div 15000$

Name__________________________
Division with Remainders

Divide

1. $6 \div 310$  
2. $33 \div 3,045$  
3. $7 \div 6,201$  
4. $72 \div 391$

5. $46 \div 1,175$  
6. $428 \div 221,044$  
7. $5 \div 328$  
8. $7 \div 624$

9. $3 \div 43$  
10. $4 \div 3,543$  
11. $18 \div 2,111$  
12. $7 \div 1856$

13. $9 \div 7,876$  
14. $3 \div 217$  
15. $72 \div 391$  
16. $74 \div 998$

17. $71 \div 6,178$  
18. $15 \div 536$  
19. $4 \div 295$  
20. $8 \div 418$
Name______________________________________

Division with 2 & 3 digit numbers

Divide

1. 25)4280  2. 32)9987  3. 19)5476  4. 52)7171

5. 37)28,325  6. 58)19,894  7. 17)12,969  8. 92)44,506

9. 74)37,312  10. 81)61,575  11. 59)39,939  12. 56)17,298


Dividing by Decimals

Divide.

1. \(0.6 \div 2.04\)  
2. \(0.14 \div 5.04\)  
3. \(3.8 \div 1.634\)  
4. \(0.03 \div 0.156\)

5. \(6.4 \div 13.44\)  
6. \(0.07 \div 16.52\)  
7. \(0.54 \div 0.3888\)  
8. \(0.72 \div 3.456\)

9. \(0.02 \div 0.0132\)  
10. \(1.3 \div 129.87\)  
11. \(4.7 \div 22.654\)  
12. \(2.9 \div 18.038\)

13. \(0.8 \div 1.352\)  
14. \(0.04 \div 0.016\)  
15. \(8.6 \div 6.45\)  
16. \(6.4 \div 428\)

17. \(7.4 \div 3.500\)  
18. \(0.87 \div 0.00435\)  
19. \(5.8 \div 15.95\)  
20. \(8.04 \div 0.602\)
Name________________________

Division by decimals (tens)

Divide

1. \(645.8 \div 100 = \) 6.458
2. \(0.006 \div 100 = \) 0.00006
3. \(22.88 \div 1000 = \) 0.02288
4. \(7000 \div 100 = \) 70
5. \(52.04 \div 1000 = \) 0.05204
6. \(189.7 \div 1000 = \) 0.1897
7. \(0.06 \div 1000 = \) 0.00006
8. \(0.85 \div 1000 = \) 0.00085
9. \(0.38 \div 100 = \) 0.0038
10. \(78.64 \div 10 = \) 7.864
11. \(799 \div 10 = \) 79.9
12. \(78 \div 10 = \) 7.8
13. \(32.58 \div 100 = \) 0.3258
14. \(645.8 \div 10 = \) 64.58
15. \(476.7 \div 10 = \) 47.67
16. \(98.95 \div 100 = \) 0.9895
17. \(0.74 \div 10 = \) 0.074
18. \(577.8 \div 100 = \) 5.778
19. \(116.4 \div 10 = \) 11.64
20. \(619.5 \div 1,000 = \) 0.6195
Dividing decimals by whole numbers

Divide

1. 73)5.11  
2. 3)70  
3. 6)1.944  
4. 5)20.35

5. 64)153.6  
6. 49)17.64  
7. 8)41.84  
8. 56)1.288

9. 37)186.11  
10. 95)783.75  
11. 87)4819.8  
12. 63)54.306

13. 22)1.122  
14. 47)117  
15. 7)535.1  
16. 4)84.12

17. 55)2.530  
18. 65)3.835  
19. 65)38.35  
20. 36)14.4
Divisibility
Write yes or no

Is the number divisible by 2?
1. 8,356
2. 53,775
3. 437
4. 29

Is the number divisible by 3?
5. 243
6. 1,200
7. 6,801
8. 11

Is the number divisible by 5?
9. 13
10. 3,750
11. 5,215
12. 773

Is the number divisible by 9?
13. 155
14. 81
15. 563
16. 4,292

Is the number divisible by 10?
17. 300
18. 6,020
19. 909
20. 898
Simplifying Fractions

Find the lowest terms fraction for each.

1. \( \frac{6}{10} = \) _____
2. \( \frac{15}{25} = \) _____
3. \( \frac{4}{16} = \) _____
4. \( \frac{14}{16} = \) _____
5. \( \frac{3}{15} = \) _____
6. \( \frac{5}{10} = \) _____
7. \( \frac{10}{12} = \) _____
8. \( \frac{14}{21} = \) _____
9. \( \frac{9}{15} = \) _____
10. \( \frac{10}{40} = \) _____
11. \( \frac{9}{27} = \) _____
12. \( \frac{16}{40} = \) _____
13. \( \frac{4}{10} = \) _____
14. \( \frac{6}{8} = \) _____
15. \( \frac{7}{35} = \) _____
16. \( \frac{12}{16} = \) _____
17. \( \frac{18}{27} = \) _____
18. \( \frac{2}{20} = \) _____
19. \( \frac{9}{30} = \) _____
20. \( \frac{25}{75} = \) _____
Comparing Decimals

Write >, <, or = in the square

1. \(229.783938 \square 229.7839348\)
2. \(0.999999 \square 1\)
3. \(5,674.0123 \square 5,674.123\)
4. \(6.00002 \square 6.000002\)
5. \(323,956.987453 \square 323,956.985753\)
6. \(8.034 \square 80.34\)
7. \(1.019872 \square 1.919872\)
8. \(1.00000 \square 1.00\)
9. \(0.333 \square 0.3333\)
10. \(10.0 \square 100.00000\)
11. \(57.345 \square 57.345\)
12. \(0.99999 \square 0.1\)
13. \(0.6565 \square 0.56565\)
14. \(0.456789 \square 0.789\)
15. \(0.000666 \square 0.066006\)
16. \(0.53298 \square 0.534\)
17. \(0.747447 \square 0.744774\)
18. \(0.9386 \square 0.9376\)
19. \(0.564897 \square 0.564887\)
20. \(0.000003 \square 0.00003\)
Decimals Place Value

Write the decimal

1. five hundred ninety-eight thousandths

2. thirteen thousand, five hundred twenty-two hundred-thousandths

3. one millionth

4. one thousand one millionths

5. one and ninety-eight hundredths

Write the word name for each number.

6. 0.4786

7. 13.925684

8. 143.75669

9. 0.46539

10. 5.01

Write the value of each underlined digit.

11. 0.92584

12. 23,809.23809

13. 57,174.47601

14. 0.602458

15. 2373.287892

16. 0.8745

17. 67.654327

18. 98.98762

19. 123.45678

20. 0.95284
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<th>Place Value</th>
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<td>9.</td>
<td>987,675</td>
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<tr>
<td>11.</td>
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<td>12.</td>
<td>6,846,237</td>
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<tr>
<td>13.</td>
<td>9,746,123</td>
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<tr>
<td>14.</td>
<td>25,769,075</td>
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<tr>
<td>15.</td>
<td>89,562,612</td>
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<td>16.</td>
<td>76,358,974</td>
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<td>17.</td>
<td>546,743,987</td>
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<tr>
<td>18.</td>
<td>142,259,907</td>
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<tr>
<td>19.</td>
<td>876,765,543</td>
</tr>
<tr>
<td>20.</td>
<td>908,787,576</td>
</tr>
</tbody>
</table>
# Rounding Numbers

**Round to the nearest ten**

1. 268  
2. 5409  
3. 776  
4. 1245  
5. 59  
6. 5555  

**Round to the nearest hundred**

7. 3266  
8. 1828  
9. 23,746  
10. 69,513  
11. 983  
12. 5227  
13. 4389  
14. 56,681  

**Round to the nearest thousand**

15. 77,766  
16. 26,671  
17. 42,395  
18. 48,211  
19. 1763  
20. 2994
### Estimating Differences

**Estimate.**

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<td>287</td>
<td>2.</td>
<td>581</td>
<td>3.</td>
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<td></td>
<td>- 158</td>
<td></td>
<td>- 247</td>
<td></td>
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<tr>
<td>5.</td>
<td>5698</td>
<td>6.</td>
<td>8165</td>
<td>7.</td>
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<tr>
<td></td>
<td>- 3489</td>
<td></td>
<td>- 2089</td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td>19,537</td>
<td>10.</td>
<td>4865</td>
<td>11.</td>
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<tr>
<td></td>
<td>- 5,387</td>
<td></td>
<td>- 1985</td>
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<td>4836</td>
<td>14.</td>
<td>7234</td>
<td>15.</td>
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<tr>
<td></td>
<td>- 978</td>
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<td>- 4187</td>
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<tr>
<td>17.</td>
<td>486,925</td>
<td>18.</td>
<td>689,278</td>
<td>19.</td>
</tr>
<tr>
<td></td>
<td>- 95,467</td>
<td></td>
<td>- 417,885</td>
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</tr>
</tbody>
</table>

Name__________________________
Estimating Products

Round the factors greater than ten. Then multiply the rounded factors to estimate the products.

1. \(5 \times 719 = \) 

2. \(3 \times 79 = \)

3. \(7 \times 832 = \)

4. \(37 \times 61 = \)

5. \(306 \times 48 = \)

6. \(64 \times 4 = \)

7. \(419 \times 3 = \)

8. \(43 \times 89 = \)

9. \(51 \times 39 = \)

10. \(33 \times 78 = \)

11. \(462 \times 9 = \)

12. \(377 \times 4 = \)

13. \(61 \times 59 = \)

14. \(786 \times 22 = \)

15. \(809 \times 31 = \)

16. \(575 \times 63 = \)

17. \(34 \times 73 = \)

18. \(8 \times 469 = \)

19. \(18 \times 368 = \)

20. \(29 \times 468 = \)
Determining Factors of Numbers

Write all the factors of the number.

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</thead>
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<td>2.</td>
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<tr>
<td>3.</td>
<td>91</td>
</tr>
<tr>
<td>4.</td>
<td>12</td>
</tr>
<tr>
<td>5.</td>
<td>16</td>
</tr>
<tr>
<td>6.</td>
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</tr>
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<td>16.</td>
<td>26</td>
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<td>17.</td>
<td>52</td>
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<tr>
<td>18.</td>
<td>66</td>
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<tr>
<td>19.</td>
<td>109</td>
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<tr>
<td>20.</td>
<td>29</td>
</tr>
</tbody>
</table>
Greatest Common Factor (GCF)

Write the GCF

1. 16, 24 ___________
2. 15, 35 ___________

3. 42, 105 ___________
4. 63, 81 ___________

5. 24, 49 ___________
6. 24, 72 ___________

7. 18, 27, 45 ___________
8. 35, 84 ___________

9. 12, 20, 28 ___________
10. 24, 36, 60 ___________

11. 26, 208 ___________
12. 88, 21 ___________

13. 60, 140 ___________
14. 96, 128 ___________

15. 40, 64 ___________
16. 64, 96, 112 ___________

17. 81, 108 ___________
18. 34, 51 ___________

19. 72, 180 ___________
20. 15, 80 ___________
<p>| | | | |</p>
<table>
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<tr>
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<td>5, 37</td>
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<td>4</td>
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<td>5</td>
<td>12, 18</td>
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<td>6</td>
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<td>7</td>
<td>10, 40, 50</td>
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<td>8</td>
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<td>9</td>
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<tr>
<td>20</td>
<td>5, 80</td>
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</tbody>
</table>
REFERENCES


Knowlton, JT. Culberth Middle School 6th Grade Mathematics Curriculum. Chapel Hill, NC 27516


