AN ANALYSIS OF AN INDIVIDUAL STUDY INSTRUCTIONAL APPROACH OF TEACHING MATHEMATICAL CONCEPTS TO HIGH SCHOOL VOCATIONAL OFFICE EDUCATION STUDENTS

DISSERTATION

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By

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The problem of this study was an analysis of an individual study instructional approach of teaching mathematical concepts as they relate to business needs.

The purposes were as follows: (1) to identify mathematical competencies required by business firms; (2) to further validate CVAE materials; (3) to evaluate the achievement of vocational office education students using programmed materials to review business mathematics; and (4) to develop, present, and describe a teaching model for these applications.

Programmed business mathematics review materials were specifically prepared to fit the unique format of the vocational office education class. Units involving numeration and whole numbers, fractions, decimals, and percents were developed. Students are provided explanations of business mathematics, given relevant examples, and related problems to work. Each unit is followed by a unit review and a unit test. This material was designed to be completed by the student in six to eight hours.
To evaluate the achievement of students using programmed material to review business mathematics, an experimental study was conducted to compare achievement for students using an individual study instructional approach to those using a lecture-demonstration approach. Eighty students enrolled in six pre-employment laboratory, vocational office education classes in three high schools participated in the study. The high schools were located northeast, west, and south of the Dallas-Fort Worth metropolitan area. Three classes received the individual study instructional approach, and three classes received the lecture-demonstration approach.

The analysis of covariance statistical technique was used to determine if a significant difference existed between the business mathematics achievement scores for the two groups. The difference between the achievement scores for the two groups was significant at the .076 level. Thus, it was inferred that the experimental group achieved as high or higher than the control group in business mathematics.

Based upon the results of the study, a model was developed for utilizing the business mathematics review unit. Recommendations for future studies were also made.
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CHAPTER I

INTRODUCTION

One of the major objectives of business mathematics instruction is to teach the student a skill which can be utilized in a business job. In order to accomplish this, however, the qualifications business firms require of employees must first be determined. Huffman points out that "little research has been completed on the need for business math by secretaries, accountants, and other business employees" (5, p. 199). Thus, vocational office education students in high school would likely be able to benefit from business mathematics materials which had been developed based upon the requirements of business firms.

Not only must a skill be taught which can be utilized, but also the most efficient method of instruction to teach a skill must be considered. Limited business mathematics studies (6) have shown that students taught by programmed learning methods, as compared to non-programmed methods, achieved significantly higher scores in a shorter period of time.

A study based upon business mathematics materials prepared to meet business firms' requirements and taught using a programmed learning method could provide additional needed research in the teaching of business mathematics. A
study such as this could also include both a model for teaching business mathematics and competencies for business mathematics.

Statement of the Problem

The problem of this study was an analysis of an individual study instructional approach of teaching mathematical concepts as they relate to business needs.

Purposes of the Study

The purposes of this study were as follow:

1. To identify mathematical competencies required by business firms from materials for Coordinated Vocational-Academic Education (CVAE) programs from the Texas Education Agency;

2. To further validate these CVAE materials by submitting them to vocational office education advisory committees;

3. To evaluate the achievement of vocational office education students using programmed materials to review business mathematics; and

4. To develop, present, and describe a teaching model for these applications.

Research Questions

The following research questions were used to guide the investigation.
1. What type of business mathematics are business firms requiring of clerical employees?

2. In which aspects of business mathematics should vocational office education students be prepared?

3. What is the difference between business mathematics materials designed for learning a new skill and materials designed for reviewing a skill?

4. Is it necessary that business mathematics be taught for an entire semester to a vocational office education class, or is a portion of a semester sufficient?

5. What competencies should be established for the vocational office education business mathematics course?

Background and Significance of the Study

Basic courses such as business mathematics are becoming increasingly recognized as being important in many schools' curricula for purposes other than job preparation. Business mathematics teaches skills which enables students to better understand and cope with today's economy. Business mathematics is also beginning to be used to prepare students to take standardized tests. Thus, the course's primary function, to prepare business students for employment, is taking on added significance as students and parents increasingly pressure educators to prepare students for jobs (5).

Yet, as Huffman (5) points out, courses such as business mathematics are considered to be unglamorous and,
therefore, have often been avoided and, unfortunately, continue to be. He questions why business educators accept so little responsibility for the improvement of teaching business mathematics. Huffman feels that one of the reasons for avoidance and lack of responsibility is that business educators feel that business mathematics is a reiteration of elementary school courses. Often, too, teacher education institutions do not include business mathematics methods courses in the curriculum. In addition, Huffman indicates that there has been little research completed on the need for business mathematics for business employees.

In addition to studies which have been completed regarding programmed instruction in business mathematics, Barlow (1), Walendowski (10), and Walters (11) have offered suggestions as to how business mathematics courses could be improved. Barlow (1) created a high school junior/senior elective course entitled Life Service Math. The course was a consumer mathematics course designed to meet the needs of all graduating students. The content was business mathematics oriented.

Barlow's primary purpose in constructing the course was to provide mathematics which could be applied to real-life situations. He first determined that practical application would require a level of mathematics much beyond the four fundamental operations performed with whole numbers, decimals, and simple fractions, and elementary skills using percentage. He felt that any student capable of mastering
these areas would be able to solve other, more complicated problems. However, he found that students had more difficulty analyzing problem situations correctly than they did using the appropriate computational skills to solve the problems. Thus, Barlow determined that there was a need for problem situations which would meet the following criteria.

1. The problems would involve realistic situations that made use of current data.

2. The reading level of the problems would be such that problems would not prove frustrating to students.

3. The mathematics skills necessary for problem solution would not be so involved that students would require more than minimal teacher direction.

4. Problem situations would be sufficiently varied to attract and hold the students' interest.

5. The problems would expose students to introductory experiences in using mathematics skills to understand current issues such as the energy crisis, population pressures, and the need to recycle our natural resources (1, p. 25).

In conducting the course, Barlow determined that it would be crucial to meaningful instruction to have various members of the community to participate in teaching mathematical skills. In so doing, he invited individuals in specific occupational specialty areas to lecture to his class. He also arranged for field trips so that students could observe community-related experiences first hand.

After evaluating the course through five years of change and redirection, he indicated that parents speak
enthusiastically of both the approach the course uses and the value of mathematical experiences their children gained. The interaction between adults in the community and the students proved to be a valuable learning experience for all involved. As a result, Barlow feels that the course fills a definite need and is considering its expansion in at least two areas—(1) offering it to students with less scholastic ability than those presently taking the course, and (2) including it in adult continuing education programs. He states that "Business mathematics and related disciplines should be incorporated in the education of all students" (1, p. 26).

Walendowski (10) presents a somewhat different suggestion on how the standard of business mathematics education could be improved. He feels that business mathematics textbooks have two important deficiencies: (1) the basic concepts of algebra are not taught, and (2) the logic of why operations are performed the way they are is not stressed. He points out that algebra is an indispensable tool in business and that business mathematics better prepares students to cope with problems in the business world. He contends that a better understanding of algebraic methods will aid in finding ways of performing business operations.

Walters (11) also emphasizes the necessity of improving business mathematics. He maintains that for students to understand the subject matter, teachers must evaluate student reading levels and provide assistance in the development of
their reading proficiencies. He feels that the methods of learning how to solve business problems should receive top priority and that every available aid to shorten computational time should be utilized. Further, he stresses that business mathematics teachers must update their courses to include such content as changes in the job market and the national system of measurement.

In summary, business mathematics is becoming increasingly important in many schools' curricula not only for vocational purposes, but also for use in life skills studies and as a preparation for standardized testing. Educators feel that improving business mathematics courses is important. Some suggestions for improvements are (1) to provide mathematics which could be applied to real-life situations; (2) to include the concepts of algebra and the logic of why operations are performed the way they are; and (3) to develop student reading skills, shorten computational time where possible, and update course content to allow for changes in the job market and converted systems of measurement. Educators also recommend additional research in all areas of business mathematics.

The present study identifies mathematical competencies required by business firms of vocational office education students. This study differs from other studies in that the subjects are high school students in vocational office education classes rather than college students in business mathematics classes. The study also provides further
information on the programmed teaching method and provides a teaching model for selected business mathematics principles.

Definition of Terms

For the purposes of this study, certain terms were defined as follow.

1. **Achievement** refers to the composite raw score obtained from the mathematics achievement posttest.

2. **Clerk** is a specific category of office employee. The Dictionary of Occupational Titles describes this category as follows:

   Clerk, General (clerical) office clerk, routine: Performs any combination of following and similar clerical tasks requiring limited knowledge of systems or procedures: Writes or types bills, statements, receipts, checks, or other documents, copying information from one record to another. Proofreads records or forms, counts, weighs, or measures material. Sorts and files records. Receives money from customers and deposits money in bank. Addresses envelopes or packages by hand or with typewriter or addressograph machine. Stuffs envelopes by hand or with envelope stuffing machine. Answers telephone, conveys messages, and runs errands. Stamps, sorts, and distributes mail. Stamps or numbers forms by hand or machine. Copies documents, using office duplicating equipment (9, p. 163).

3. **Lecture-demonstration approach** refers to traditional methods for presentation of new topics together with homework problems to reinforce the concept. The student progresses through activities on a fixed time basis.

4. **Pre-employment laboratory** is a classroom situation in which training is designed to provide technical
instruction and practical experience for high school students preparing to enter employment in the business field.

5. Programmed instruction is instruction presented in small, sequenced units in which answers are provided and through which students can work at their own rates.

6. Vocational office education is a program of vocational instruction designed to prepare, maintain, and advance people in stenographic, secretarial, and related office occupations.

Delimitations

This study included those students enrolled in pre-employment laboratory classes of three high schools. These high schools are located northeast, west, and south of the Dallas-Fort Worth metropolitan area.

Basic Assumptions

It was assumed that students would respond honestly and carefully to the instruments used for measurement purposes.
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A review of business mathematics, utilizing programmed instruction, is the focal point of this study. The business mathematics review for this study is designed specifically for the vocational office education pre-employment laboratory class. Thus, the amount of time which can be devoted to such a review is restricted due to the nature of the class. A review of business mathematics must be limited to an amount of time considerably shorter than a quarter, a semester, or two semesters.

Research studies in business mathematics utilizing programmed instruction as compared to a lecture-demonstration approach are limited. The studies which have been completed concentrate on a time period of at least a quarter. Although the length of the business mathematics course varies from that in the present study, many factors are similar.

Since this study is based upon programmed business mathematics materials designed for vocational office education students, this chapter has been restricted to related research in the field of business mathematics.
The Myers Study

The purpose of this study was to compare the effectiveness of teaching business mathematics to college students by programmed learning methods as compared with non-programmed learning methods (7). Students in the experimental group used programmed learning materials, while students in the non-programmed group used a traditional textbook. Materials used for both groups were based upon textbooks by Snyder and Huffman. The subject areas included in the study were as follow: (1) simple interest and applications, (2) distribution of ownership and profits, (3) merchandising mathematics, and (4) depreciation. Classroom procedures for the non-programmed group included lectures, explanations, demonstrations, discussions, and question and answer exchanges. The procedures for the programmed group included the assignment of programs to be completed during the class period or as outside work.

As a result of his work, Myers found the following.

1. There was no significant difference, at the .05 level, in pretest scores of the students in either class; however, there was a significant difference in posttest scores in favor of the students using programmed learning methods.

2. Time and score findings indicated that students taught business mathematics by programmed learning methods achieved significantly higher achievement scores in a shorter period of time than a comparable group of students taught by non-programmed learning methods.
The fact that Myers studied and compared programmed and non-programmed learning in business mathematics makes his study similar to the present study. However, Myers' subjects were business mathematics college students rather than high school vocational office education students. Also, the students were studying business mathematics for a full quarter rather than reviewing business mathematics for approximately two weeks.

The Swindle Study

The Swindle study was similar to the Myers study. A business mathematics course, Business Calculations, was used in Swindle's study (10). He hoped to improve student performance in business mathematics by programming instruction. One class in Business Calculations was used as a control group with instruction administered in the traditional manner, while programmed instruction was used with the experimental class.

Pretests were given to both the experimental and control groups. These tests indicated that the experimental group began at a lower level of mathematic competency than the control group and that the gap eventually closed. When students completed all work necessary for this semester course, they were allowed to leave. A comparison of test scores between the control group and the experimental group indicated that the programmed group gained a greater mastery of materials than did the control group. There were also
fewer dropouts in the programmed class. Early completion was a motivational factor, as seven students completed the programmed course by mid-semester.

Swindle suggested that additional research was needed regarding a programmed approach to teaching business mathematics. Swindle's study of teaching business mathematics to college students using both a traditional approach and a programmed approach is similar to the present study. However, Swindle's study differs from the present one in that he worked with college students who were enrolled for a semester course in business mathematics.

The Liguori Study

The purpose of Liguori's study was to assess the applicability of the Personalized System of Instruction (P.S.I.) for teaching business mathematics to college students (5). The Personalized System of Instruction uses small units of material which the student must master in order to advance to the next unit. Each student can advance at his or her own rate.

Two sections of the business mathematics course were taught with the P.S.I. method, while two sections were taught by a more traditional lecture method. The two P.S.I. taught classes had combined initial enrollments of eighty-four, and the traditionally taught classes had combined initial enrollments of forty-three.
A college mathematics textbook by Freund was the basic source of information for the P.S.I. groups. Students completed selected assignments from the textbook, primarily outside of class. Students progressed from one unit to the next based upon a predetermined proficiency level.

The control groups used the same college mathematics textbook as the P.S.I. groups. The teaching procedures used for the control groups were lectures and class discussions. Students were given daily homework assignments.

Unlike Myers' and Swindle's studies, Liguori found no mean differences dependent upon the teaching methods in the students' scores on the posttest. Liguori felt that this might have been due to the similarity between teaching methods and small class size.

Liguori's study compared two methods, the Personalized System of Instruction and a more traditional lecture method, of teaching business mathematics. Thus, his study is similar to the present one. However, he was teaching business mathematics to college students who were enrolled in a semester course.

The Pappin Study

The purpose of this study was to assess junior college students' progress in business mathematics using programmed materials as compared to students using more traditional textbook materials and a more traditional teaching method (9).
As a result of her study, Pappin found the following:

1. The group using programmed materials had a higher percentage of course completion;
2. A larger percentage of students passed the course;
3. There was a lower percent of withdrawals and failures due to excessive absences; and,
4. A larger percentage of students enrolled in at least one additional mathematics course.

Pappin's study differs from the present one on two major points. First, she was teaching junior college students rather than high school students, and second, her business mathematics class was a semester course.

The Williams Study

Williams' purpose in conducting the study was to compare a mastery learning strategy with a conventional learning strategy in business mathematics at Iowa Western Community College (12). The instructional techniques for the mastery learning strategy included small group peer instruction, small group teacher instruction, and programmed instruction. The conventional teaching strategy employed the lecture-discussion method. All students in the study took the same pretest, unit examinations, and final examination.

Based upon the results of unit examinations, Williams found that the mastery treatment accounted for significant improvements in performance when the subject matter was of
moderate difficulty. However, no significant differences in performances were found with the mastery treatment with either the least difficult or the most difficult unit.

Williams' study is similar to the present one, as he was comparing business mathematics students' progress when taught using two different approaches—a programmed approach and a lecture/discussion approach.

Unlike the present study, however, Williams' subjects were college students rather than high school students. Also, the course was a quarter in length rather than a briefer period of time.

The Folz Study

The purpose of the Folz study was to test the quality of programmed materials that had been written on percent relations for a college course called Problems of Business Transactions (2). This course was divided into two groups. One group studied from programmed materials only and the other group learned through the teacher's lecture only.

In assessing the findings of her study, Folz determined that there was no significant difference in the achievement between the learning accomplished by the lecture group and the programmed group.

The Folz study is similar to the present one, as it explores the progress of students' learning by means of programmed materials and teacher lecture. The Folz study differs from the present one, as the students were college
students, rather than high school students, enrolled in a semester course rather than a course limited to a briefer time period.

The Neaville Study

The purpose of this study was twofold—(1) to determine if programmed instruction facilitates the learning of business mathematics as compared to standard text and (2) to determine if students using programmed text can learn faster than students using non-programmed text (8).

The subjects of this study were high school students enrolled in business mathematics. A programmed textbook was used for the experimental group; students worked at their own rates through the material. The control group used a standard textbook and was taught with regular classroom methods used in business mathematics.

Based upon the results of the pre-test and post-test given to the subjects, Neaville found no significant difference in the learning or achievement level of the two groups. However, he did find a significant savings of time when using the programmed text.

Neaville compared programmed and non-programmed learning in business mathematics for high school students, making his study similar to the present one. However, Neaville's subjects were enrolled in a business mathematics class scheduled for a school year, as opposed to students
being enrolled in vocational office education and reviewing business mathematics for no more than two weeks.

The Judson Study

Judson compared the effectiveness of a programmed textbook method of reviewing fractions with a non-programmed method (4). Two general business high school classes were used in the study. Students in one class used a programmed textbook through which they could work at their own rates. Students in the other class were taught by a lecture-chalkboard demonstration approach. This group was given mimeographed handouts from which assignments were worked.

A posttest was used to determine the achievement for both groups. No significant difference was found between students in the programmed group and those in the non-programmed group.

Judson's study is similar to the present one, as he compared the effectiveness of programmed and non-programmed learning with high school students. However, Judson's study concentrated on a review of only fractions for students enrolled in general business classes. Therefore, his study differs from the present one, as students in the present study reviewed not only fractions but also whole numbers, decimals, and percents. Also these students were enrolled in vocational office education classes.
The Campbell Study

Campbell's primary objective was to revise the Huffman text, which was prepared for post-high school students, for high school use (1). Campbell was dealing with the fundamentals of business mathematics. Eighteen high school students completed the study. Based upon students' errors, the program was changed until the error rate dropped from 16 per cent to 5.1 per cent. The average class gain between the pretest and the posttest was 75.4 per cent. The posttest contained 13 items.

Campbell made the following conclusions: (1) approximately 95 per cent of all future students taking this program would fall within an error range between zero and 11.7 per cent, (2) based upon the gain scores, the program improved the students' knowledge of business mathematics fundamentals, (3) programs developed for high school students need smaller steps than those programs for post-high school students, (4) the program can be completed within twenty class periods, and (5) students were generally favorable to the program.

Campbell's study is similar to the present one in that high school students were using programmed materials designed for business mathematics. However, the present study is different from Campbell's as there was an experimental group and a control group, subjects were vocational office education students rather than business mathematics students, and the program can be completed in less than twenty hours.
The Jones Study

The objective of Jones' study was to adjust a post-high school programmed business mathematics textbook by Huffman to a level suitable for high school students of low ability (3). The program was devised with the intent that students' completed work would be approximately 95 per cent accurate.

Jones found that, through continual revision of his initial program, the error rate dropped from 8.03 per cent to 2.83 per cent. Therefore, he concluded that high school students of low ability could complete the adjusted program with less than a 5 per cent error rate. Since test score averages for these students rose from 78.2 to 87.3, he concluded that students of below average ability can successfully perform on the retention tests used to measure the result of the programmed unit on fundamentals of business mathematics.

Jones' study is similar to the present one as high school students from an office training program were the subjects; they were using a programmed approach to studying business mathematics. However, the study differs from the present one in that there was only an experimental group consisting of fifteen students whose I.Q. scores were 100 or below. The present study contained both a control group and an experimental group; these consisted of intact vocational office education laboratory classes. Also students in Jones' study were expected to complete the assigned work within
twenty hours, as opposed to assignments being completed in approximately ten hours in the present study.

The Musick Study

Musick adapted a post-high school programmed unit dealing with the mathematics of ordinary and exact interest to junior and senior high school students (6). The basis for the material used in this study was an original programmed unit on interest developed by Huffman. Six high school students completing an eleventh grade, first-year bookkeeping course were the subjects for the study. Musick found that the adapted materials could be successfully used with the addition of approximately 36 per cent more material.

Musick's study is similar to the present one, as his subjects were high school students using a programmed approach to studying business mathematics. However, Musick's study included only an experimental group, a limited number of students, and the material covered dealt only with interest in business mathematics.

The Weaver Study

The purpose of the Weaver study was to determine the type of errors high school students make using programmed business mathematics (11). She was also interested in adapting the business mathematics material by Huffman, which had been specifically prepared for post-high school and college freshmen students, to the high school level so that students could perform with a 5 per cent or less error.
The major emphasis of the programmed business mathematics material was to build speed and accuracy in applying the skills and concepts related to addition, subtraction, multiplication, and division.

Weaver found that errors were grouped according to lack of comprehension of concepts introduced, carelessness, and computational errors. Although the error rate did not drop consistently between the first and second round of testing, it did decrease about 9 per cent.

The primary similarity between the Weaver study and the present one is that programmed material was used to teach business mathematics. The Weaver study is unlike the present one, as there was no control group; a concentration on only the functions of addition, subtraction, multiplication, and division; and, a limited number of high school students, who were not vocational office education students.

Summary

The majority of the research studies reviewed evaluated programmed instruction in college business mathematics classes as compared to a lecture-demonstration method. Myers, Swindle, Pappin, and Williams found that there was a significant difference in the achievement of students studying business mathematics with a programmed approach. Whereas, Liguori, Folz, Neaville, and Judson found no significant difference in students' achievement.
Campbell, Jones, Musick, and Weaver concentrated on adapting portions of a Huffman business mathematics college textbook for use at the high school level. The Huffman textbook was programmed as were the adaptations. These four studies utilized only an experimental group; in general they found that the college textbook could be adapted to the high school level.

All but Judson conducted research with business mathematics classes. The subjects of the experimental research studies were college students with the exception of the Neaville and Judson studies. These two research studies had high school subjects. Also the experimental research studies were centered around material which was designed to be used for at least a quarter of a school year. None of the studies incorporated a review of business mathematics nor a review of business mathematics for vocational office education students. The present study employed a review of business mathematics for high school vocational office education students utilizing programmed instruction.
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CHAPTER III

PROCEDURES FOR DEVELOPING THE BUSINESS

MATHEMATICS REVIEW MATERIAL

One of the major purposes of a business mathematics course is to provide the student with a skill which will have practical application on the job. The business mathematics review material in this study was organized and designed around this purpose. The material was prepared to be used in the high school vocational office education pre-employment laboratory class. Because of the unique structure of the vocational office education class, in which many different subjects are presented during a school year, the business mathematics review material was specifically prepared to comply with this format. Therefore, the business mathematics review course utilized the programmed learning method and was designed to be completed by the student in approximately six to eight hours.

Content

The programmed business mathematics review course is based upon a Coordinated Vocational-Academic Education (CVAE) program from the Texas Education Agency entitled Mathematics Academic Guide for Office Duplication (1). Permission was
obtained from the Director of the Occupational Curriculum Laboratory at East Texas State University to use this Mathematics Academic Guide.

During the summer of 1982, the following four units were developed.

1. Numeration and Whole Numbers -- Students are given numbers in word form and asked to write them in numerical form. The placement of the commas in numbers is explained. The material for whole numbers deals with a review of addition, vertical and horizontal; subtraction; multiplication; and division. Also included in this unit is finding the average (arithmetic mean) for a group of whole numbers. In this unit whole numbers are used in payroll records, delivery route records, and other types of business record keeping.

2. Fractions -- The unit on fractions includes an introduction to fractions plus addition, subtraction, multiplication, and division of fractions. Fractions are used with practical business applications.

3. Decimals -- This unit first defines the decimal, then students add, subtract, multiply, and divide decimals. Also included in this unit are the following: rounding off decimals, comparing the size of decimals, changing fractions to decimals, and changing decimals to fractions. Decimals are used in problems which have business applications.
4. Percents -- The material in this unit contains an introduction to percents, changing decimals to percents, changing percents to decimals, changing fractions to percents, and changing percents to fractions. These exercises are in preparation for the following: finding the percent of a number, finding what percent one number is of another, and finding a number when a percent of it is given. The problems related to percents have practical business applications.

With the programmed material, students are provided explanations of business mathematics and are given relevant examples. Students are given related problems to work so that they can incorporate the principles they are studying. As students work through the material and complete the problems, answers are provided for immediate feedback. Following each unit is a unit review and a unit test.

Process

Perkins outlines a fifteen-step strategy for preparing instructional programs (2). The first seven steps provide a plan for writing a programmed sequence or preparing an entire course outline. The last eight steps are designed specifically for the preparation of self-instructional programmed materials. Steps nine through fifteen were used as a guide for writing the business mathematics review material in this study.
In step nine, Perkins emphasizes that the instructional frames being constructed should include only essential data. That is, a lean draft should be written. In following this step, short instructional segments in each unit identifies objectives, related examples are given, and required activities are provided.

Perkins' step ten outlines a procedure for drafting individual frames and obtaining feedback on the completed frames. This step was implemented, as suggested, by writing the first draft of each frame on a 5 x 8 card. The material was written a unit at a time. Each unit contains, in addition to the instructional segments, objectives and related examples in each unit, a unit review for self-evaluation, and a unit test for teacher evaluation. When a unit had been written, it was reviewed first by a mathematician who read the instructions, worked each problem, and recorded the amount of time she needed to complete the unit. This person then offered suggestions concerning the clarity of instructions, relevancy and appropriateness of problems, and any other pertinent areas. Comments and suggestions for revisions were written on the back of the relevant card. Revisions were incorporated, and the unit was reviewed by a business education consultant who read the material and gave suggestions for further improvements.

Corrections were made, and the material was then ready for two students to complete. Two high school students, who
had weak backgrounds in mathematics, were given the unit. One student at a time worked through the material. Each student also indicated suggested changes in the material on the back of the pertinent card. Each student kept a record of the amount of time necessary to complete the unit.

Step eleven involves additional revision. Based upon observations of and inputs from the students, changes were again effected. Perkins cautions that care should be taken to revise only that which is absolutely necessary to accomplish the goal of getting students to perform at a certain level of proficiency on the criterion examination.

Of the total two hundred eighty-nine frames developed, unit one contained forty frames; unit two, one hundred twenty-five; unit three, eighty; and unit four, forty-four. Completion time for the four units ranged from six to eight hours.

The material was then typed in final form in preparation for validation by vocational office education advisory committees and for the pilot study. A professional artist was employed to create cartoon characters which would be included in the format. The typed material was arranged for printing, and the cartoon characters were incorporated.

Prior to the implementation of step twelve, which is the administration of the material to a pilot group, further validation of the business mathematics review was necessary.
Validation

To further validate that the CVAE materials were applicable to business use, the programmed business mathematics unit was sent to three vocational office education advisory committees. The committees were located in Dallas, Texas; Fort Worth, Texas; and Duncanville, Texas. The chairman for each committee acted as the contact person. All committee chairmen received the same material, which included the following: a letter of explanation, the business mathematics review unit, a response form, and a return envelope. Each chairman was asked to check one of the following two statements:

-- The business mathematics review contains material applicable to business use.

-- The business mathematics review is material not applicable to business use.

The response sheet contained space for the chairmen to make any comments that they deemed appropriate. An affirmative response from all three chairman was received and was considered sufficient to indicate validity for the business mathematics review unit.

Pilot Study

In step twelve of Perkins' strategy for preparing instructional programs, he suggests that a small group similar to the target population be selected and that the materials being prepared be administered to the students in this group. Students should be told the nature of the
experiment and asked to record any remarks which they may have. Thus, a pilot study was done with twenty-seven students enrolled in two vocational office classes at a high school located northeast of the Dallas-Fort Worth metropolitan area. The primary purposes in conducting the pilot study were to confirm the amount of time needed to complete the business mathematics review, to obtain feedback from the students regarding clarity of instructions and material, and to determine if errors still existed in the copy. Also, these examinations were administered to the students in the pilot study classes in order to determine reliability for the pretest and the posttest used in this study.

Students were asked to keep a record of the amount of time needed to complete the business mathematics review; they were to spend approximately one hour per day working through the review until it was finished. In completing a unit or a portion of a unit, each student wrote on the materials the time she began working and the time she completed her work every day. Students in both classes, which were taught by the same instructor, were first given the pretest. They then began to work through the materials. If a student had a comment or a correction, she was to write this on the appropriate page of the materials. Although the business mathematics review was programmed, students were encouraged to ask the instructor's aid if they had questions. The instructor tape recorded any remarks or questions which a student had.
In step thirteen Perkins emphasizes the importance of revising again from the small-group analysis. To prepare for this, he feels it is particularly important that an analysis of the items be made to determine possible revisions of any given item. So that any necessary revisions of the business mathematics review could be effected, students' oral and written comments were carefully scrutinized, all items were examined, and students' time records were noted. Students reported no problems regarding clarity of either instructions or material. No revisions in the material were made after items were analyzed. Two errors were discovered in the copy. Students completed the business mathematics review in six to eight hours. Thus, as a result of the pilot study, no significant additional changes were made.

Steps fourteen and fifteen of Perkins' plan involve administration of the material to students in a formal classroom situation. This, in turn, leads to the editing and preparation of the final draft. These steps are detailed in the following chapters.

CHAPTER IV

PROCEDURES FOR COLLECTING AND TREATING THE DATA

This experimental study was designed to compare achievement for students who were using an individual study instructional approach with students who were using a more traditional lecture-demonstration approach. An understanding of the procedures used in this experimental study is essential to accurate interpretation of the findings and conclusions.

Setting of the Experiment

Business mathematics is becoming increasingly important as is the need for improvement of instruction in these courses. To further improve instruction, programmed instruction in business mathematics was developed for vocational office education high school students. This experiment was completed in vocational office education classes of three high schools located northeast, west, and south of the Dallas-Fort Worth metropolitan area during the fall semester of 1982. Students in six vocational office classes received either the individual study instructional approach or the lecture-demonstration approach.
The students involved in this study consisted of those students enrolled in six pre-employment laboratory, vocational office education classes during the fall semester of 1982. A table of random numbers was used to determine which three classes would receive the individual study instructional approach (4). The remaining three classes received the lecture-demonstration approach. Of the three high schools participating in the study, two schools had one instructor each who taught two different pre-employment, vocational office education classes. In the third high school, there were two instructors, each of whom taught one pre-employment laboratory class. A total of forty-two students was assigned to the individual study instructional approach and thirty-eight students to the lecture-demonstration approach.

Instructional Procedures

The pre-employment laboratory, vocational office education classes in each of the three high schools required instructions on the ten-key adding machine or the ten-key electronic calculator. Instructors introduced students to operating the machines by touch, explained the procedures for adding, subtracting, multiplying, and dividing on the machines, and allowed the students enough practice time to familiarize themselves with the machines.
On the first day of the time period scheduled for the experiment during the fall semester of 1982, students completed the business mathematics pretest. Since it was not imperative that the experiment be conducted simultaneously at the participating schools, each instructor was able to select a time period of approximately two weeks during the fall semester which was most appropriate for her pre-employment class or classes taking part in the experiment. In addition, students completed the Otis-Lennon Mental Ability Test during the first week of the experiment.

During the second week of the experiment, after students had completed the other course requirements, the business mathematics posttest was administered. This examination was the one used for measurement of achievement in this study. All students were given the same amount of time to complete both the pretest and the posttest. Also, the instructor was present when each test was administered to the students.

**Individual Study Instructional Approach**

As detailed in Chapter III, a programmed business mathematics review course was developed during the summer of 1982. The materials for this course were to be used for those students in the individual study instructional approach group. In accordance with Perkins' step fourteen for the preparation of self-instructional programmed materials (3), the
business mathematics materials were tested with a large group. Forty-two students participated in this part of the experiment.

The business mathematics review contained all instructions necessary for completion by the student; therefore, teacher instructions were unnecessary. Students were to spend approximately one hour per day working through the materials. Thus, when a student completed the pretest, he or she could begin on the review. Instructors were asked to aid students if they had questions.

Each of the four units in the business mathematics review contains explanations of business mathematics and pertinent examples. Students were given related problems to work so that they could incorporate the principles they were studying. Following each unit was a review which provided students an opportunity to evaluate their progress. Reference for each question was furnished so that if a student made an error, immediate access to an appropriate explanation and a relevant example was available. If after checking the reference, a student still did not understand the question or answer, then the student was instructed to request aid from the instructor. When a student felt that the material presented in a unit had been learned and that any errors made on the unit review were understood, the student then took the unit test. As a student finished the
unit test, it was graded by the instructor who determined whether the student was ready to proceed to the next unit or should do additional review on the same unit.

Following the completion of this part of the experiment, Perkins' step fifteen (3) was implemented. As he suggests, the business mathematics review material was edited, and the final draft was prepared.

Lecture-Demonstration Approach

During the approximate two-week period designated, the instructors for the lecture-demonstration group covered the following four business mathematical areas: (1) numeration and whole numbers, (2) fractions, (3) decimals, and (4) percents. (A summary of the Coordinated Vocational-Academic Education information presented to the lecture-demonstration group is presented in Appendix B.) The instructor used the chalkboard, examples, and applications to supplement the lecture presentation. All lectures were given at the beginning of the class period. After the classroom presentation of the concept, students were given an assignment sheet which contained related problems. In an attempt to equate the material received by both groups, students in the lecture-demonstration group received the same number of practice problems as those students in the individual study instructional approach group. Also the
practice problems which the students in the lecture-demonstration group received were the same as or similar to those in the individual study instructional approach group.

Testing Procedures

Achievement

An extensive search revealed that there was no appropriate published instrument available to measure business mathematical concepts examined in this study. It was necessary to develop both the business mathematics pretest and posttest that were used to obtain achievement scores needed for this study.

Problems for both the pretest and the posttest were selected from the applied business mathematics concepts under evaluation. One examination was used for both the pretest and the posttest; a total of fifty problems were included. (The business mathematics examination used to measure achievement is included in Appendix C.)

In order to establish reliability for the examination, the pretest/posttest was administered to students in two pre-employment laboratory, vocational office education classes during the fall semester of 1982. Administration of this examination was an integral part of the pilot study detailed in Chapter III. Students in each class took the pretest/posttest prior to beginning the business mathematics review course. Students again took the pretest/posttest following completion of the review course. Scores obtained
for each test were divided into split halves. Then Pearson Product Moment Correlation Coefficients were determined for each test. The Spearman Brown Prophecy Formula was used to determine the adjusted reliability correlation coefficient for each test. The adjusted reliability correlation coefficient for the pretest was .95, and the adjusted reliability correlation coefficient for the posttest was .93.

The validity of the achievement pretest/posttest was determined by a panel of five judges. All judges received the same material, which included the following: a letter of explanation, a description of instructional materials used in the study, a copy of the pretest/posttest, a response form, and a return envelope. All judges were asked the following question to establish the validity for the examination:

Will this test adequately determine whether a student can work problems in the mathematical areas involved in this study?

Judges were able to make additional comments either on the response sheet, since extra space was provided, or on the copy of the pretest/posttest. The tests were to be accepted as valid instruments if three of the five panel members responded in the affirmative.

The panel of five judges was composed of the following: two community college instructors and three senior high school teachers. Each panel member had at least ten years of experience teaching business mathematics, business machines, and/or pre-employment laboratory, vocational office
education. In addition, two of the panel members had published at least one book in the field of business machines or business mathematics.

All five panel members returned the response forms after the first mailing. All five panel members responded affirmatively. Since the pretest/posttest received more than the necessary three votes needed to indicate validity, the test was accepted as a valid measuring instrument.

**Intelligence Test**

The Otis-Lennon Mental Ability Test was administered to students in both groups in this study. The test has six levels; Form J of the advanced level was used in this experiment. Regarding test validity, Milholland indicates that this is organized in accordance with the content, criterion-related, and construct categories of the 1966 Standards for Educational and Psychological Tests and Manuals. He further states that the test has adequate correlation with educational criteria and with other measures of general scholastic aptitude (1).

Concerning test reliability, reliability coefficients were determined using both the split-half method and Kuder-Richardson Formula 20. The split-half reliability coefficients were corrected by use of the Spearman-Brown Prophecy Formula. Reliability coefficients that range from .93 to .95 have been obtained on the various forms of the test (2).
Statistical Analysis

In this study the analysis of covariance was used to test for significant differences in measurement of achievement between the experimental and control groups. Scores obtained from the mathematical pretest and the Otis-Lennon Mental Ability Test were used as covariates.
CHAPTER BIBLIOGRAPHY


CHAPTER V

PRESENTATION AND ANALYSIS OF THE DATA

An experimental study was conducted to analyze results obtained by an individual study instructional approach (experimental group) and a lecture-demonstration approach (control group). The purpose of the experimental aspect of this study was to demonstrate the usefulness of the business mathematics review materials. The experiment was completed in six pre-employment laboratory, vocational office education classes of three high schools located northeast, west, and south of the Dallas-Fort Worth metropolitan area during the fall semester of 1982. Eighty students participated in the study. The individual study group was composed of forty-two students. The lecture-demonstration group was composed of thirty-eight students.

The information obtained for statistical treatment was related to business mathematics achievement. The business mathematics achievement was measured by administering a posttest to all students who were involved in the experiment. In addition, all students took a business mathematics pretest and the Otis-Lennon Mental Ability Test. Scores for all measurements were tabulated for each student who completed the course and who completed all the tests. (The data used in the statistical analysis are included in Appendix D.)
Randomly assigning students to the individual study group and the lecture-demonstration group was not feasible. Therefore, the analysis of covariance was used to statistically control initial differences between the groups. Scores from the business mathematics achievement pretest and the Otis-Lennon Mental Ability Test were used as covariates. Data related to the covariates are reported in Table I.

**TABLE I**

<table>
<thead>
<tr>
<th>Summary of the data related to the covariants of initial business mathematics achievement and mental ability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group</td>
</tr>
<tr>
<td>----------</td>
</tr>
<tr>
<td>Experimental</td>
</tr>
<tr>
<td>Control</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>

The control group had a business mathematics achievement pretest mean score which was 3.84 points higher than the experimental group. However, students in the control group had approximately the same mean score on the Otis-Lennon Mental Ability Test as students in the experimental group.

At the completion of the business mathematics course requirements, all students in the experiment took a posttest consisting of fifty mathematical problems. Students were
given a class period (approximately fifty-five minutes) to complete the examination. Also, students were given permission to use calculators and adding machines to facilitate mathematical computations. Scores for each student were determined by the number of problems answered correctly. The mean score, standard deviation, and the adjusted mean score for the business mathematics achievement posttest are reported in Table II.

TABLE II

SUMMARY OF THE DATA RELATED TO THE MEAN SCORES ON THE BUSINESS MATHEMATICS ACHIEVEMENT POSTTEST

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Mean Score</th>
<th>S.D.</th>
<th>Adjusted Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental</td>
<td>42</td>
<td>36.17</td>
<td>7.62</td>
<td>37.02</td>
</tr>
<tr>
<td>Control</td>
<td>38</td>
<td>35.66</td>
<td>8.28</td>
<td>34.72</td>
</tr>
</tbody>
</table>

The mean posttest score for the experimental group was .51 points higher than the control group. However, when the analysis of covariance statistical technique was used to adjust for initial differences, the experimental group's mean score was 2.30 points higher than the control group's business mathematics achievement posttest mean score.

The results of the analysis of covariance used to analyze the data are presented in Table III.
TABLE III
SUMMARY OF THE ANALYSIS OF COVARIANCE OF THE BUSINESS MATHEMATICS ACHIEVEMENT TEST SCORES
N = 80

<table>
<thead>
<tr>
<th>Source</th>
<th>Degrees of Freedom</th>
<th>Sum of Squares</th>
<th>Mean Square</th>
<th>F Value</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>77</td>
<td>2452.61</td>
<td>. . .</td>
<td>. . .</td>
<td>. . .</td>
</tr>
<tr>
<td>Within</td>
<td>76</td>
<td>2352.48</td>
<td>30.95</td>
<td>. . .</td>
<td>. . .</td>
</tr>
<tr>
<td>Difference</td>
<td>1</td>
<td>100.13</td>
<td>100.13</td>
<td>3.23</td>
<td>.076</td>
</tr>
</tbody>
</table>

The analysis of covariance of the mean posttest scores yielded an F value of 3.23, which is significant at the .076 level. Based upon this finding, it can be inferred that the experimental group achieved as high or higher than the control group in business mathematics.
CHAPTER VI

SUMMARY, MODEL, AND RECOMMENDATIONS

Summary

The problem of this study was an analysis of two different approaches to teaching business mathematics as it relates to business needs. The results obtained by an individual study instructional approach (experimental group) and a lecture-demonstration approach (control group) were the basis for statistical comparisons.

The purposes of this study were as follow: (1) to identify mathematical competencies required by business firms from materials for Coordinated Vocational-Academic Education (CVAE) programs from the Texas Education Agency; (2) to further validate these CVAE materials by submitting them to vocational office education advisory committees; (3) to evaluate the achievement of vocational office education students using programmed materials to review business mathematics; and (4) to develop, present, and describe a teaching model for these applications.

To accomplish these purposes, CVAE materials containing business mathematics that business firms require of clerical employees were identified. So that these materials could be used in the unique format of the pre-employment
laboratory, vocational office education class, they had to be specifically prepared to meet this need. During the summer of 1982, units involving the following four business mathematics areas were developed: (1) numeration and whole numbers, (2) fractions, (3) decimals, and (4) percents. In these materials, students are provided explanations of business mathematics and are given relevant examples. Students are given related problems to work so that they can incorporate the principles they are studying. As students work through the material and complete the problems, answers are provided for immediate feedback. Each unit is followed by a unit review and a unit test.

Seven steps designed specifically for the preparation of self-instructional programmed materials were used as a guide for writing the business mathematics review material in this study. The seven steps are as follow: (1) include only essential data in the instructional frames being constructed; (2) draft individual frames and obtain feedback on the completed frames; (3) revise the material based upon observation and feedback; (4) administer the material to a pilot group; (5) revise the material as a result of the pilot study; (6) administer the material to students in a formal classroom situation; and (7) edit and prepare the final draft.

Following preparation of the business mathematics review material, it was submitted to three vocational office education advisory committees to be further validated as
being applicable to business use. The committees were located in Dallas, Texas; Fort Worth, Texas; and Duncanville, Texas. The three committees affirmed that the materials were applicable to business use; this was considered sufficient to indicate validity.

After the materials were written and validated, a pilot study was conducted. Twenty-seven students enrolled in two pre-employment laboratory, vocational office education classes at a high school located northeast of the Dallas-Fort Worth metropolitan area were participants in the pilot study. The major purposes of the pilot study were to confirm the amount of time needed to complete the business mathematics review, to obtain feedback from the students regarding clarity of instructions and material, and to determine if errors existed in the copy. Also, to establish reliability for the pretest and the posttest used in this study, these examinations were administered to the students in the pilot study classes.

Students kept a record of the amount of time needed to complete the business mathematics review; they spent approximately one hour per day working through the material. As they worked through the material, students recorded pertinent comments and corrections. Although the business mathematics review was programmed, students were encouraged to ask the instructor's aid if they had questions.
Students' comments were analyzed, and they reported no problems regarding clarity of either instructions or material. Items in the material were examined; no revisions were made as a result. Students completed the business mathematics review in six to eight hours. Based upon the results of the pilot study, no significant additional changes were made.

To evaluate the achievement of vocational office education students using programmed material to review business mathematics, an experimental study was conducted during the fall semester of 1982. Eighty students enrolled in six pre-employment laboratory, vocational office education classes in three high schools participated in the study. The high schools were located northeast, west, and south of the Dallas-Fort Worth metropolitan area. A table of random numbers was used to determine which three classes would receive the individual study instructional approach. The remaining three classes received the lecture-demonstration approach. Four teachers were involved in the experimental study.

Prior to the conduction of the experiment, students in the experimental group and the control group received instructions on the ten-key adding machine or the ten-key electronic calculator from their instructors. On the first day of the time period scheduled for the experiment for each class in each group, students completed the business mathematics pretest. Students also completed the Otis-Lennon
Mental Ability Test during the first week of the experiment. During the second week of the experiment, after students had completed the other course requirements, the business mathematics posttest was administered.

The students in the individual study instructional approach group used the programmed business mathematics materials. Since all instructions were contained within the materials, teacher instruction was unnecessary. However, instructors were asked to aid students if they had questions. In addition, instructors were asked to grade each unit test in the materials and determine whether a student was ready to proceed to the next unit.

Instructors for the lecture-demonstration group covered the following four business mathematical areas: (1) numeration and whole numbers, (2) fractions, (3) decimals, and (4) percents. Each instructor used the chalkboard, examples, and applications to supplement the lecture presentation. After each topic was presented in class, students were given an assignment sheet containing related problems. These practice problems were the same as or similar to those used by the experimental group. The control group also received the same number of practice problems as the experimental group.

Both the experimental group and the control group completed the same achievement test. A business mathematics pretest and posttest were constructed to measure business
mathematics concepts examined in this study. One examination was used for both the pretest and the posttest. Validity and reliability were established for the examination. The pretest/posttest was administered to each class during the first day of the experiment and again when students completed unit requirements.

The Otis-Lennon Mental Ability Test was administered to all students in the experiment. In addition, the mental ability test scores were needed for statistical treatment of the data.

The analysis of covariance was the statistical procedure employed in this experimental study. This technique was used to test for significant differences in measurement of achievement between the experimental and control groups with regard to business mathematics achievement.

The difference between the adjusted mean achievement scores for the experimental group and the control group yielded an F value of 3.23, which is significant at the .076 level. Thus, it can be inferred that the experimental group achieved as high or higher than the control group in business mathematics.

Model

Vocational office education is a program of vocational instruction designed to prepare, maintain, and advance people
in stenographic, secretarial, and related office occupations. Vocational office education programs are generally operated under a cooperative plan or a pre-employment laboratory plan. In the schools which participated in this experimental study, the cooperative plan is a one-year program. Twelfth-year students attend cooperative education class one period in the morning for related instruction and work on the job during the afternoon. The pre-employment laboratory plan is also a one-year program. The pre-employment laboratory is a classroom situation in which training is designed to provide technical instruction and practical experience for high school students preparing to enter employment in the business field. This plan is designed for eleventh- or twelfth-year students. Students attend class for a two-period block of time either in the morning or the afternoon.

The pre-employment laboratory is used for group and individual instruction in office skills and related subjects. The curriculum is based upon the need of the student or students. The following are examples of skills and related subjects which may be included in the curriculum: production typewriting, business mathematics, filing, calculator and ten-key adding machine, office procedures, banking, proofreading, machine shorthand, word processing, and spelling. The number of skills and preparatory subjects is extensive; this is a major element which accounts for the uniqueness of the pre-employment laboratory.
Most courses are designed to be taught for a semester or for two semesters. This type of course in textbook form is difficult to use effectively in a pre-employment laboratory setting. The instructor generally resorts to adapting material from a textbook or from more than one textbook to meet the need of the student in the time allocated for teaching skills and preparatory subjects. The business mathematics review material developed in this study is designed for the vocational office education class.

Concise, comprehensive units which can be utilized by one student or a group of students are most appropriate for vocational office education classes. Instructors who participated in this experimental study indicated that although they felt that business mathematics was an extremely important subject for their students, a unit suitable for the vocational office education class was unavailable. Therefore, they did not ordinarily review business mathematics with their students or had difficulty incorporating it into their programs.

A brief business mathematics unit which contains a review of the fundamental processes of arithmetic and which would provide the student with a skill which would have practical application on the job would be valuable to both student and instructor. This was the objective in developing the programmed business mathematics review materials used in this study. To accomplish this, Coordinated Vocational-Academic Education materials which contained business
mathematics that business firms require of clerical employees were identified. Programmed material provides a student the opportunity to work through a unit at his or her own rate. Programmed material, being self-contained regarding instruction, example problems, and practice problems, alleviates instructor preparation and instruction time. Therefore, the CVAE business mathematics review materials were programmed; this would provide an appropriate unit for the vocational office education class.

Perkins (1) outlines a fifteen-step strategy for preparing instructional programs. Steps nine through fifteen which are designed specifically for the preparation of self-instructional programmed materials were used as a guide for writing the business mathematics review material in this study. To evaluate the achievement of vocational office education students using the business mathematics review material, an experimental study was conducted. Based upon the results of the study, the following guidelines were developed for utilizing the business mathematics review unit.

1. Students should work through the material as it is organized. The four segments of the unit are sequenced as follows: numeration and whole numbers, fractions, decimals, and percents. This sequence allows the student a smooth transition from one segment to the next.
2. Students should have calculators or ten-key adding machines available for use. Prior to students' beginning work on the material, instructors should introduce students to operating the machines by touch, explain the procedures for adding, subtracting, multiplying, and dividing on the machines, and allow the students enough practice time to familiarize themselves with the machines.

3. Students should spend approximately forty-five minutes to one hour each day working through the material until it is completed. Students become too tired and lose concentration if they work longer than an hour.

4. Students will require about six to eight hours of class time to complete the business mathematics review. Of course, some students may complete the unit in less than six hours, and others may require more than eight hours. Absenteeism is one of the major reasons for the need for additional time.

5. Use of the answer mask should be emphasized to students. This is important even though students who participated in the study were very conscientious about its use. Each response frame is followed by the correct answer in the next frame. Therefore, it is important that students cover the answer, respond, then check the answer.

6. Instructors should be present to answer students' questions. Although students who participated in the study had few questions as they worked through the material, instructors were available to aid students.
7. The score on each test will indicate a student's readiness to progress to the next segment. Following each of the four segments is a review and a test. Each review and test has instructions for grading. A student should have a passing grade on each test before proceeding to the next segment or, in the case of the final segment, taking the final examination.

8. The posttest which was a part of the experimental study can be used as the final examination for the business mathematics review. Validity and reliability were established for this test.

9. Students find decimals and percents difficult to understand. Students should be cautioned to work through the material dealing with decimals and percents slowly and thoroughly. If these two segments were to be changed, it would be to include additional practice problems and additional tests. Since students work with decimals and percents sporadically, their retention level of the concepts is low. Therefore, the material dealing with decimals and percents could be reworked just prior to a student's completing the vocational office education class; this would be particularly advantageous if a student were seeking employment. The business mathematics review could also be used as a reference for the student who needs a quick review of these concepts.
Recommendations for Future Research

1. One student who participated in this study was reading at the eighth grade level and was partially deaf; this student worked through the programmed material well and achieved well. It is recommended that a future study be done to determine the achievement of special students using programmed business mathematics.

2. Future studies should be undertaken to determine whether additional practice problems for the decimal and percent segments would improve achievement and retention.

3. Future studies should be undertaken to further determine the needs of business firms regarding their requirements of beginning clerical employees in business mathematics.

4. Future studies should be undertaken to create and test materials to fit the needs of the vocational office education class.
CHAPTER BIBLIOGRAPHY

APPENDIX A

An example of the business mathematics review materials used by students in the individual study instructional group for instructional purposes is presented in Appendix A.
UNIT 4
PERCENTS
Percent means hundredths (as in decimals). Percent means that a quantity has been divided into a hundred parts.

25% means $\frac{25}{100}$ of a quantity.
100% means a whole quantity.
200% means a quantity has been doubled.

To change a decimal to a percent, move the decimal point two places to the right and add the percent sign.

Examples: 
- .20 = 20%
- .03 = 3%
- .5 = 50%

Change .7 to a percent. Underline the correct answer.

7% 70% .7%

Change .09 to a percent. Is the correct answer 9%?
Circle YES or NO.

YES NO

Change .33 to a percent.

YES
Study the following examples in which decimals are changed to percents.

.009 = .9%
.034 = 3.4%
1.18 = 118%

Change .003 to a percent. Draw an arrow to the correct answer.

.3%  3%  30%

.116 changed to a percent is which one of the following? Circle 1 or 2.
1) 1.16%  2) 11.6%

2.01 = ___%

To change a percent to a decimal, move the decimal point two places to the left and drop the percent sign. You may need to add zeros to the left of the number before moving the decimal point.

Examples:  8% = .08
           33% = .33
           42.5% = .425
           7.2% = .072
11

Change 95% to a decimal. Circle the correct answer.

9.5  .095  .95

12

Change 100% to a decimal. Place brackets around the correct answer.

1.00  .100  .0100

13

Change 2% to a decimal. Place a check mark beside the correct answer.

.02  .002  .20

14

Change these percents to decimals.

a) 34.2% =

b) 216% =

15

To change a fraction to a percent, divide the denominator (bottom number) into the numerator (top number), and carry the answer to hundredths, unless it comes out even before then.

Examples: \( \frac{1}{4} = 4 \div 1 = 0.25 \)

\( \frac{3}{8} = 8 \div 3 = 0.375 \)

\( .25 = 25\% \)

\( .375 = 37.5\% \)
16

Change \( \frac{3}{4} \) to a percent. Cross out the incorrect answer.

\[
75\% \quad .75
\]

17

Change \( \frac{2}{5} \) to a percent. Circle A, B, or C to indicate the correct answer.

A. .04  B. 4.00%  C. 40%

18

Change the following fractions to percents.

a. \( \frac{7}{8} = \) _______

b. \( \frac{1}{16} = \) _______

19

a. 87.5\% or 87 \( \frac{1}{2} \)%

b. 6.25\% or 6 \( \frac{1}{4} \)%

To convert a percent to a fraction, make the number of the percent the numerator and 100 the denominator. Reduce the fraction to the lowest terms.

Examples:

\[
50\% = \frac{50}{100} = \frac{1}{2}
\]

\[
5\% = \frac{5}{100} = \frac{1}{20}
\]

20

Change 10\% to a fraction. Place a check mark beside the correct answer and an X beside the incorrect answer.

\[
\frac{10}{100} \quad \frac{1}{10}
\]
Change 80% to a fraction. Underline the correct answer.

\[
\frac{80}{1000} \quad \frac{8}{10} \quad \frac{4}{5}
\]

Change these percents to fractions.

a) 40% = \\
b) 2% = 

In working with percentage problems, you will find two types of possibilities. You will be asked to find

1. A percent of some quantity or
2. What percent one quantity is of another

To find the percent of a quantity,

1. Change the percent to a decimal
2. Multiply the number by the decimal
3. The product (answer) is the percent of the quantity.

Example: 40% of 112 is 44.80

\[
\begin{array}{c}
112 \text{ (Number)} \\
x \cdot 0.40 \text{ (Decimal)} \\
44.80 \text{ (Product)}
\end{array}
\]
25

Find the percent of a number.

40% of 110 is which of the following. Circle the correct answer.

\[ 2.75 \quad .44 \quad 44 \]

26

\[ 110 \times .40 = 44 \]

Find the percent of a number.

20% of 30 is one of the following. Place a check mark beside the correct answer.

\[ _600 \quad _6 \quad _{.6} \]

27

\[ \checkmark 6 \]

Find the percent of these numbers.

a) 10% of 50 = _______

b) 75% of 60 = _______

28

There are 30 students in a class. Seventy percent of the students are girls. How many are girls?

Place brackets around the correct answer.

\[ 21 \quad 15 \quad 18 \quad 12 \]
29

One day 5% of the 40 students in Mrs. Homes' class made perfect scores on a math test. How many students made perfect scores?
Draw an arrow to the correct answer.

15 10 5 2

30

Find the income tax due on taxable income of $2,250.50 when the rate is 22%.

$2,250.50 \times 0.22 = \$495.11$

To find what percent one number is of another number

1. Decide which of the numbers is the base quantity (denominator) in the problem.
2. Decide which number is part of the base number (numerator).
3. Divide the base into the part to get a decimal.
4. Change the decimal into a percent.

Example: What percent of 100 is 30?

\[
\frac{30 \text{ (Part)}}{100 \text{ (Base)}} = 0.30 = 30\
\]

32

What percent of 45 is 15? Circle 1 or 2.

1. 3% 2. 33.33%
33

What percent of 8 is 2? Underline the correct answer.

25%  4%  16%

34

Solve the following problems.

A. 8 is what percent of 16? __________
B. $12 is what percent of $60? __________

2/8 = 25%

35

A. 50%
B. 20%

A team played 50 games and won 30. What percent of the games did they win? Cross out the incorrect answers.

60%  45%  40%

36

Cindy answered 47 questions correctly on a test of 50 questions. What percent of the questions did she answer correctly? Circle the letter of the correct answer.

a. 23%  b. 94%  c. 10%  d. 75%

37

A coffeemaker priced at $30 is reduced $10 in price. What is the percent of discount? ___
To find a number when a percent of it is given

1. Change the percent to a decimal or a fraction.
2. Divide the number by this decimal or fraction.

Example: \( 30\% \) of \( \_\_\_\_ \) = 6

\[
30\% = .30 \text{ (Decimal)}
\]

\[
.30 \div 6 \quad 30\% \text{ of } 20 = 6
\]

20\% of \( \_\_\_\_ \) = 25. Place a check mark beside the correct answer and an X beside the incorrect answer.

\[
\checkmark 125 \quad \underline{x} \quad 80
\]

80\% of \( \_\_\_\_ \) = 60. Is the correct answer 133? Circle YES or NO.

YES \quad \underline{\text{NO}}

Solve the following problems.

A. \( 20\% \) of \( \_\_\_\_ \) = 25

B. \( 10\% \) of \( \_\_\_\_ \) = 127
An office supply store sold 75% of its typewriter ribbons, and the number of ribbons sold was 150. How many ribbons did the store originally have? (Circle the correct answer.)

A. 125  B. 1,270

Amy paid 80% of the regular selling price for a calculator. If she paid $20, what was the original selling price? Place a check mark beside the correct answer.

___ $16  ___ $25  ___ $34  ___ $20

How much money must Stacey put into a savings account that earns 6% interest to earn $96 for the first year? Place brackets around the correct answer.

$576  $1,600  $824  $1,096
CONGRATULATIONS!

You have finished Unit 4 and the entire program.

Complete the Unit 4 Review and the Unit 4 Test.
UNIT 4 REVIEW

Frames 1 and 2
Change the following decimals to percents.
A. .5 = ________
B. .24 = ________
C. .067 = ________

A. 50%
B. 24%
C. 6.7%

Frame 10
Change the following percents to decimals.
A. 72% = ________
B. 8% = ________
C. 230% = ________

A. .72
B. .08
C. 2.30

Frame 15
Change the following fractions to percents.
A. $\frac{3}{5}$ = ________
B. $\frac{1}{10}$ = ________
C. $\frac{7}{25}$ = ________

A. 60%
B. 10%
C. 28%
Frame 19

Change the following percents to fractions.

A. 45% = ______
B. 33% = ______
C. 8% = ______

A. \( \frac{9}{20} \)
B. \( \frac{33}{100} \)
C. \( \frac{2}{25} \)

Frame 24

Find the percent of the following.

A. 20% of 100 = ______
B. 25% of 40 = ______
C. Mr. Reese bought a new chair, regularly selling for $120, at a sale and saved 20%. How much did he save?

C. The number of people at the game this week was 75% of what it was last week. Last week there were 800 people at the game. How many people were at the game this week?

A. 20
B. 10
C. $24
D. 600
Frame 31

Solve the following problems.

A. What percent of 72 is 9? _______

B. 8 is what percent of 32? _______

C. In a class of 48 students, six were absent. What percent of the class was absent? _______

D. A store charged $240 for a typewriter and made a profit of $43.20. What was the percent of profit? _______

   A. 12 \( \frac{1}{2}\)%
   B. 25%
   C. 12 \( \frac{1}{2}\)%
   D. 18%

Frame 38

Solve the following problems.

A. 80% of _____ = 60

B. 51% of _____ = 51

C. 75% of _____ = 12

D. The football team won 38 games, which was 95% of their scheduled games. How many games were on their schedule? _______

E. If silver ore contains 10% silver, how many pounds of ore are needed to get 14 pounds of silver? _______

   A. 75
   B. 100
   C. 16
   D. 40
   E. 140
UNIT 4 TEST

Change the following decimals to percents.
1. .8 = _____
2. .33 = _____
3. .025 = _____

Change the following percents to decimals.
4. 65% = _____
5. 1% = _____
6. 215% = _____

Change the following fractions to percents.
7. \( \frac{1}{5} = _____ \)
8. \( \frac{3}{10} = _____ \)
9. \( \frac{3}{50} = _____ \)

Change the following percents to fractions.
10. 25% = _____
11. 60% = _____
12. 4% = _____

Find the percent of the following.
13. 10% of 50 = ______
14. 75% of 60 = ______
15. What would the sales tax be at 5% if you bought a typewriter for $145.95? ______
16. A typewriter originally cost $289.65 but is on sale for 25% off. What are the savings? ______
Solve the following problems.

17. What percent of 160 is 60? _______

18. $40 is what percent of $800? _______

19. A desk priced at $400 is reduced to $80 in price. What is the percent of discount? _______

20. An office equipment store charged $325 for a file cabinet and made a profit of $65. What was the percent of profit? _______

21. $37\%$ of _____ = 52

22. $12 \frac{1}{2}\%$ of _____ = 15

23. $18\%$ of _____ = 216

24. An office equipment store sold 320 pocket calculators. This was $20\%$ of the stock. How many pocket calculators were there originally? _______

25. An office manager paid $75\%$ of the regular selling price for a duplicating machine. If she paid $2,100, what was the original selling price? _______
APPENDIX B

The instructional material used by students in the lecture-demonstration classes is presented in Appendix B.
UNIT A

NUMERATION

MATHEMATICS

OBJECTIVE

You will be able to read and write numbers, ordering them according to value.

INTRODUCTORY INFORMATION

Many times you will find numbers written in word form (four hundred dollars) as well as numerical form ($400). Checks are a good example. When you receive your paycheck, you will be able to read it correctly.

PROCEDURE

Write the following numbers in neat numerals, with commas inserted where necessary.

QUESTIONS, PROBLEMS, AND/OR ACTIVITIES

1. three hundred fifty-four reams
2. six thousand thirty cases
3. twenty-five sheets
4. eighteen thousand five hundred sixty-four cases
5. eight hundred eight reams
6. sixteen reams
7. eight hundred ninety-nine cases
8. nine thousand two hundred three cases
9. eighty-three sheets
10. two hundred sixty-five reams
11. four thousand five cases
12. eighteen reams
13. fourteen thousand three hundred ten cases
14. seven hundred nineteen reams
15. one thousand nine hundred seventy-six cases
OBJECTIVE

You will be able to correctly add whole numbers by beginning with the addition of two one-digit numbers and progressing to the addition of six five-digit numbers.

INTRODUCTORY INFORMATION

It is necessary that you be able to add whole numbers so you can figure the daily and weekly totals in payroll records and your grades.

PROCEDURE

1. Add horizontally to find total hours worked for one week.
2. Add horizontally to find weekly total.
3. Add vertically to find daily total. The daily total and weekly total must add up to same figure.

QUESTIONS, PROBLEMS, AND/OR ACTIVITIES

1. 

<table>
<thead>
<tr>
<th>EMPLOYEE</th>
<th>HOURS WORKED</th>
<th>TOTAL HOURS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>T</td>
</tr>
<tr>
<td>BROWN, JAMES</td>
<td>8</td>
<td>7</td>
</tr>
<tr>
<td>BURTON, DAVID</td>
<td>9</td>
<td>8</td>
</tr>
<tr>
<td>CAVAZOS, ABEL</td>
<td>9</td>
<td>8</td>
</tr>
<tr>
<td>DAY, JOHN</td>
<td>7</td>
<td>8</td>
</tr>
<tr>
<td>EVERSD, CLAYTON</td>
<td>9</td>
<td>8</td>
</tr>
<tr>
<td>GATES, GEORGE</td>
<td>7</td>
<td>9</td>
</tr>
</tbody>
</table>

2. 

<table>
<thead>
<tr>
<th>RT. NO.</th>
<th>MON.</th>
<th>TUE.</th>
<th>WED.</th>
<th>THUR.</th>
<th>FRI.</th>
<th>WEEKLY TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>$323.45</td>
<td>$252.84</td>
<td>$198.75</td>
<td>$303.03</td>
<td>$176.03</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>104.15</td>
<td>302.85</td>
<td>233.47</td>
<td>217.85</td>
<td>149.50</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>152.63</td>
<td>298.32</td>
<td>423.82</td>
<td>189.76</td>
<td>385.76</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>281.74</td>
<td>183.56</td>
<td>102.98</td>
<td>236.51</td>
<td>298.73</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>112.87</td>
<td>321.47</td>
<td>258.76</td>
<td>176.70</td>
<td>102.15</td>
<td></td>
</tr>
</tbody>
</table>

DAILY TOTAL
OBJECTIVE

You will be able to correctly subtract whole numbers beginning with two one-digit numbers and progressing to two five-digit numbers.

INTRODUCTORY INFORMATION

All of us are interested in saving money. You can save money by paying cash instead of buying on the installment plan. This information would be very important for you to know if you were to go into business.

PROCEDURE

Subtract cash price from installment price to find savings.

QUESTIONS, PROBLEMS, AND/OR ACTIVITIES

<table>
<thead>
<tr>
<th>ITEM</th>
<th>INSTALLMENT PRICE</th>
<th>CASH PRICE</th>
<th>SAVINGS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Typewriter</td>
<td>$598.75</td>
<td>$550.50</td>
<td></td>
</tr>
<tr>
<td>Desk</td>
<td>99.99</td>
<td>84.75</td>
<td></td>
</tr>
<tr>
<td>Adding Machine</td>
<td>399.95</td>
<td>375.75</td>
<td></td>
</tr>
<tr>
<td>Calculator</td>
<td>39.99</td>
<td>30.99</td>
<td></td>
</tr>
<tr>
<td>Stapler</td>
<td>175.93</td>
<td>153.82</td>
<td></td>
</tr>
<tr>
<td>Paper Drill</td>
<td>284.76</td>
<td>242.95</td>
<td></td>
</tr>
<tr>
<td>Copier</td>
<td>879.87</td>
<td>801.95</td>
<td></td>
</tr>
<tr>
<td>Punch &amp; Binder</td>
<td>436.23</td>
<td>395.78</td>
<td></td>
</tr>
<tr>
<td>Chair</td>
<td>95.75</td>
<td>89.95</td>
<td></td>
</tr>
</tbody>
</table>
OBJECTIVE

You will correctly multiply whole numbers beginning with two one-digit numbers and progressing to five-digit numbers by three-digit numbers.

INTRODUCTORY INFORMATION

Multiplication of whole numbers is needed in Office Duplication because numerous problems occur in your lab work and activity work where multiplication is required to find the answer.

PROCEDURE

Solve the following problems and be sure to show your work.

QUESTIONS, PROBLEMS, AND/OR ACTIVITIES

1. How many copies can be reproduced in eight hours if you can print an average of 1,850 copies an hour? ______________

2. If each quire has 24 sheets, how many sheets are there in 15 quires? ______________

3. If each sheet weighs four ounces, how much will 10,000 sheets weigh in ounces? ______________

4. How many copies can be reproduced in 10 hours if you can print 1,025 copies an hour? ______________

5. If one ream contains approximately 500 sheets, how many sheets will be in 2,582 reams? ______________

6. What is the average daily production of four automatic presses if the average per hour is 3,850 copies on each press, and the time is eight hours per day? ______________

7. If there are 28 lines of type on each page, how many lines will there be in a book of 348 pages? ______________
OBJECTIVE

You will be able to correctly divide whole numbers beginning with two one-digit numbers and progressing to division of six-digit numbers by three-digit numbers.

INTRODUCTORY INFORMATION

You must be able to divide to find the unit cost when given the quantity and total cost.

PROCEDURE

Divide quantity into total cost to find the unit cost.

QUESTIONS, PROBLEMS, AND/OR ACTIVITIES

<table>
<thead>
<tr>
<th>QUANTITY</th>
<th>STOCK NO.</th>
<th>UNIT PRICE</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>24</td>
<td>P-125</td>
<td></td>
<td>$1,248.00</td>
</tr>
<tr>
<td>52</td>
<td>C-186</td>
<td></td>
<td>224.00</td>
</tr>
<tr>
<td>56</td>
<td>D-44</td>
<td></td>
<td>1,456.00</td>
</tr>
<tr>
<td>85</td>
<td>Y-78</td>
<td></td>
<td>1,445.00</td>
</tr>
<tr>
<td>16</td>
<td>A-410</td>
<td></td>
<td>720.00</td>
</tr>
<tr>
<td>38</td>
<td>F-111</td>
<td></td>
<td>494.00</td>
</tr>
<tr>
<td>54</td>
<td>C-189</td>
<td></td>
<td>1,550.00</td>
</tr>
</tbody>
</table>
OBJECTIVE

You will be able to find the average (arithmetic mean) of a group of whole numbers.

INTRODUCTORY INFORMATION

You must be able to add and divide whole numbers so you can figure average grades, stencils, hours, etc.

PROCEDURE

Complete the charts, following directions given.

QUESTIONS, PROBLEMS, AND/OR ACTIVITIES

A. Add horizontally to find total stencils typed for one week. Divide total stencils by five to find daily average. Add horizontally to find total. Divide total by 10 to find average.

<table>
<thead>
<tr>
<th>EMPLOYEE NO.</th>
<th>NO. OF STENCILS TYPED</th>
<th>TOTAL STENCILS</th>
<th>DAILY AVERAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>T</td>
<td>W</td>
</tr>
<tr>
<td>001</td>
<td>21</td>
<td>31</td>
<td>29</td>
</tr>
<tr>
<td>002</td>
<td>50</td>
<td>35</td>
<td>28</td>
</tr>
<tr>
<td>003</td>
<td>25</td>
<td>28</td>
<td>24</td>
</tr>
<tr>
<td>004</td>
<td>30</td>
<td>53</td>
<td>35</td>
</tr>
<tr>
<td>005</td>
<td>26</td>
<td>29</td>
<td>24</td>
</tr>
<tr>
<td>006</td>
<td>35</td>
<td>38</td>
<td>31</td>
</tr>
<tr>
<td>007</td>
<td>28</td>
<td>26</td>
<td>29</td>
</tr>
<tr>
<td>008</td>
<td>51</td>
<td>34</td>
<td>29</td>
</tr>
<tr>
<td>009</td>
<td>16</td>
<td>21</td>
<td>20</td>
</tr>
<tr>
<td>010</td>
<td>25</td>
<td>22</td>
<td>30</td>
</tr>
</tbody>
</table>

B. Add horizontally to find total. Divide total by 10 to find average.

<table>
<thead>
<tr>
<th>STUDENT NO.</th>
<th>GRADES</th>
<th>TOTAL GRADES</th>
<th>AVERAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1301</td>
<td>95 92 93 94 96 93 97 90 96 90</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1302</td>
<td>90 90 85 89 91 83 91 89 84 86</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1303</td>
<td>97 93 80 86 94 85 90 90 85 90</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1304</td>
<td>98 92 90 96 94 95 95 95 95 90</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1305</td>
<td>89 81 90 92 88 85 85 86 84 90</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Name__________________________

ACTIVITY SHEET

1. In the following fractions identify the numerator and denominator of each by filling in the blanks.

   ✓ a. In the fraction \( \frac{5}{7} \), the numerator is _____ and the denominator is _____.

   ✓ b. In the fraction \( \frac{8}{18} \), 8 is the _____ and 18 is the _____.

   ✓ c. In the fraction \( \frac{1}{2} \), what is the numerator? _____ denominator? _____

2. Write fractions which fit the following statements.

   ✓ a. A fraction with a denominator of 17 and numerator of 10. _____

   ✓ b. A fraction with a numerator of 16 and a denominator of 37. _____

3. A man cuts a pie into 8 equal pieces and then eats 1 of the 8 pieces.

   ✓ a. Which number represents the numerator? _____

   ✓ b. Which number represents the denominator? _____

   ✓ c. What fractional part of the pie did the man eat? _____
OBJECTIVE

You will be able to identify the parts of a fraction and to write fractions correctly in their different forms.

INTRODUCTORY INFORMATION

Office duplication requires that students know how to fractionally divide a page in order to center pictures and words.

PROCEDURE

Draw a suitable figure to represent each of the following fractions.

Example: \( \frac{5}{6} \)

QUESTIONS, PROBLEMS, AND/OR ACTIVITIES

1. \( \frac{1}{4} \)

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

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

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

5. \( \frac{11}{12} \)

6. \( \frac{8}{16} \)
Adding Fractions with Like Denominators

ACTIVITY SHEET

10. \( \frac{3}{7} + \frac{3}{7} = \)  

11. \( \frac{3}{12} + \frac{8}{12} = \)  

12. \( \frac{2}{8} + \frac{2}{8} = \)  

13. \( \frac{4}{8} + \frac{3}{8} = \)  

14. \( \frac{2}{4} + \frac{1}{4} = \)  

15. \( \frac{9}{16} + \frac{4}{16} = \)  

16. \( \frac{1}{2} + \frac{1}{2} = \)  

17. \( \frac{3}{32} + \frac{10}{32} = \)  

18. \( \frac{22}{64} + \frac{21}{64} = \)  

19. \( \frac{5}{8} + \frac{2}{8} = \)  

20. \( \frac{3}{16} + \frac{6}{16} = \)
ACTIVITY SHEET

Add the following and reduce your answer to lowest terms.

1. $\frac{3}{8} + \frac{1}{8} = \underline{\phantom{0000}}$

2. $\frac{7}{12} + \frac{1}{12} = \underline{\phantom{0000}}$

3. $\frac{1}{4} + \frac{1}{4} = \underline{\phantom{0000}}$

4. $\frac{13}{32} + \frac{15}{32} = \underline{\phantom{0000}}$

5. $\frac{27}{7} + \frac{21}{24} = \underline{\phantom{0000}}$

6. $\frac{3}{5} + \frac{4}{8} + \frac{1}{9} = \underline{\phantom{0000}}$

7. $\frac{5}{14} + \frac{1}{14} = \underline{\phantom{0000}}$

8. $\frac{4}{8} + \frac{2}{3} = \underline{\phantom{0000}}$

9. $\frac{3}{24} + \frac{8}{32} = \underline{\phantom{0000}}$

10. $\frac{4}{32} + \frac{2}{32} = \underline{\phantom{0000}}$

11. $\frac{3}{15} + \frac{2}{15} = \underline{\phantom{0000}}$

12. $\frac{3}{18} + \frac{3}{18} = \underline{\phantom{0000}}$

13. $\frac{3}{4} + \frac{1}{4} = \underline{\phantom{0000}}$

14. $\frac{2}{8} + \frac{2}{8} = \underline{\phantom{0000}}$

15. $\frac{4}{10} + \frac{2}{10} = \underline{\phantom{0000}}$

16. $\frac{1}{35} + \frac{4}{35} = \underline{\phantom{0000}}$

17. $\frac{2}{32} + \frac{9}{32} = \underline{\phantom{0000}}$

18. $\frac{7}{16} + \frac{7}{16} = \underline{\phantom{0000}}$
ACTIVITY SHEET

Add these mixed numbers.

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Add:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>$4 \frac{1}{4}$</td>
<td>$3 \frac{3}{4}$</td>
</tr>
<tr>
<td>2.</td>
<td>$2 \frac{3}{12}$</td>
<td>$4 \frac{4}{12}$</td>
</tr>
<tr>
<td>3.</td>
<td>$12 \frac{1}{4}$</td>
<td>$15 \frac{5}{4}$</td>
</tr>
<tr>
<td>4.</td>
<td>$26 \frac{3}{12}$</td>
<td>$3 \frac{1}{3}$</td>
</tr>
<tr>
<td>5.</td>
<td>$15 \frac{12}{12}$</td>
<td>$4 \frac{1}{3}$</td>
</tr>
<tr>
<td>6.</td>
<td>$8 \frac{3}{4}$</td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>$6 \frac{2}{4}$</td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>$8 \frac{1}{3}$</td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td>$2 \frac{4}{5}$</td>
<td></td>
</tr>
<tr>
<td>10.</td>
<td>$3 \frac{2}{12}$</td>
<td></td>
</tr>
<tr>
<td>11.</td>
<td>$3 \frac{5}{7}$</td>
<td></td>
</tr>
<tr>
<td>12.</td>
<td>$2 \frac{3}{12}$</td>
<td></td>
</tr>
<tr>
<td>13.</td>
<td>$4 \frac{2}{12}$</td>
<td></td>
</tr>
</tbody>
</table>
Adding Fractions with Unlike Denominators

Add the following fractions, reducing all answers to lowest terms.

I. a. \( \frac{1}{2} \)  
   + \( \frac{1}{4} \)  
   + \( \frac{1}{4} \)  
   + \( \frac{1}{4} \)  

b. \( \frac{3}{5} \)  
   + \( \frac{1}{5} \)  
   + \( \frac{1}{5} \)  
   + \( \frac{1}{5} \)  

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

II. a. \( \frac{1}{3} \)  
   + \( \frac{1}{3} \)  
   + \( \frac{1}{3} \)  
   + \( \frac{1}{3} \)  

b. \( \frac{1}{4} \)  
   + \( \frac{1}{4} \)  
   + \( \frac{1}{4} \)  
   + \( \frac{1}{4} \)  

c. \( \frac{2}{5} \)  
   + \( \frac{1}{5} \)  
   + \( \frac{1}{5} \)  
   + \( \frac{1}{5} \)  

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

h. \( \frac{5}{12} \)  
   + \( \frac{1}{12} \)  
   + \( \frac{1}{12} \)  
   + \( \frac{1}{12} \)
ACTIVITY SHEET

Adding Mixed Numbers with Unlike Denominators

Add and reduce to lowest terms.

1. \(5 \frac{7}{12} + 4 \frac{1}{6}\)
2. \(8 \frac{1}{2} + 5 \frac{1}{4}\)
3. \(7 \frac{3}{4} + 8 \frac{1}{5}\)
4. \(4 \frac{2}{5} + \frac{2}{10}\)
5. \(2 \frac{1}{10} + \frac{5}{10}\)
6. \(9 \frac{1}{3} + 5 \frac{2}{3}\)
7. \(5 \frac{2}{3} + 4 \frac{3}{8}\)
8. \(8 \frac{3}{5} + 2 \frac{3}{4}\)
9. \(4 \frac{1}{2} + 2 \frac{3}{4}\)
10. \(1 \frac{1}{2} + \frac{7}{13}\)
UNIT C
FRACTIONS

OBJECTIVE
You will be able to add fractions.

INTRODUCTORY INFORMATION
You will need to be able to add fractions in order to figure how many hours you worked.

PROCEDURE
Find the total hours worked for each employee.

QUESTIONS, PROBLEMS, AND/OR ACTIVITIES

<table>
<thead>
<tr>
<th>EMPLOYEE</th>
<th>M</th>
<th>T</th>
<th>W</th>
<th>TH</th>
<th>F</th>
<th>S</th>
<th>TOTAL HOURS</th>
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<tr>
<td>Alvarado, Carlita</td>
<td>7 3/4</td>
<td>8</td>
<td>7 1/2</td>
<td>8 1/4</td>
<td>7 3/4</td>
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<td>Brown, Charles T.</td>
<td>8</td>
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<td>8 1/4</td>
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<td>7 3/4</td>
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<td>Cantu, Jesus A.</td>
<td>7 3/4</td>
<td>7 1/2</td>
<td>8</td>
<td>7 3/4</td>
<td>8</td>
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<tr>
<td>Cardwell, Sam</td>
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<td>8</td>
<td>7 3/4</td>
<td>8</td>
<td>7 1/2</td>
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<td>Davis, John R.</td>
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<td>8</td>
<td>8</td>
<td>7 3/4</td>
<td>8</td>
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<td>7 3/4</td>
<td>8</td>
<td>8</td>
<td>6</td>
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<td></td>
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ACTIVITY SHEET

Subtracting Fractions with Like Denominators

Subtract these problems and reduce the answer.

1. \( \frac{7}{8} - \frac{2}{8} = \)
2. \( \frac{3}{4} - \frac{1}{4} = \)
3. \( \frac{2}{3} - \frac{1}{3} = \)
4. \( \frac{7}{12} - \frac{1}{12} = \)
5. \( \frac{3}{6} - \frac{2}{6} = \)
6. \( \frac{7}{12} - \frac{1}{12} = \)
7. \( \frac{14}{32} - \frac{7}{32} = \)
8. \( \frac{3}{4} - \frac{2}{4} = \)
9. \( \frac{5}{8} - \frac{3}{8} = \)
10. \( \frac{7}{11} - \frac{2}{11} = \)
11. \( \frac{13}{16} - \frac{3}{16} = \)
12. \( \frac{8}{8} - \frac{1}{8} = \)
13. \( \frac{5}{7} - \frac{2}{7} = \)
14. \( \frac{9}{16} - \frac{3}{16} = \)
Subtraction of Fractions and Mixed Numbers

Subtract:

1. \( \frac{5}{8} \)  
2. \( \frac{4}{5} \)  
3. \( \frac{3}{3} \)  
4. \( \frac{13}{16} \)  
5. \( \frac{1}{2} \)  
6. \( \frac{4}{11} \)  

- \( \frac{1}{3} \)  
- \( \frac{2}{3} \)  
- \( \frac{3}{2} \)  
- \( \frac{9}{2} \)  
- \( \frac{2}{3} \)  
- \( \frac{4}{5} \)  

Answer key:

1. \( \frac{5}{8} \)  
2. \( \frac{4}{5} \)  
3. \( \frac{3}{3} \)  
4. \( \frac{13}{16} \)  
5. \( \frac{1}{2} \)  
6. \( \frac{4}{11} \)  

- \( \frac{1}{3} \)  
- \( \frac{2}{3} \)  
- \( \frac{3}{2} \)  
- \( \frac{9}{2} \)  
- \( \frac{2}{3} \)  
- \( \frac{4}{5} \)
### Subtracting Fractions with Unlike Denominators

Subtract the following fractions, then reduce all answers to lowest terms.

<p>| | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td>1.</td>
<td>( \frac{3}{4} )</td>
<td>-</td>
<td>( \frac{1}{2} )</td>
<td>( \frac{1}{2} )</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>( 6 \frac{4}{5} )</td>
<td>-</td>
<td>( 3 \frac{2}{3} )</td>
<td>( 3 \frac{2}{3} )</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>( 12 \frac{5}{6} )</td>
<td>-</td>
<td>( 10 \frac{2}{5} )</td>
<td>( 10 \frac{2}{5} )</td>
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<tr>
<td>4.</td>
<td>( 17 \frac{3}{9} )</td>
<td>-</td>
<td>( 3 \frac{1}{3} )</td>
<td>( 3 \frac{1}{3} )</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>( 9 \frac{5}{7} )</td>
<td>-</td>
<td>( 5 \frac{1}{3} )</td>
<td>( 5 \frac{1}{3} )</td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>( 12 \frac{1}{12} )</td>
<td>-</td>
<td>( x )</td>
<td>( x )</td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>( 64 \frac{7}{8} )</td>
<td>-</td>
<td>( 30 \frac{3}{4} )</td>
<td>( 30 \frac{3}{4} )</td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>( 8 \frac{11}{15} )</td>
<td>-</td>
<td>( 5 \frac{7}{10} )</td>
<td>( 5 \frac{7}{10} )</td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td>( 124 \frac{5}{6} )</td>
<td>-</td>
<td>( 63 \frac{5}{9} )</td>
<td>( 63 \frac{5}{9} )</td>
<td></td>
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<tr>
<td>10.</td>
<td>( 83 \frac{7}{8} )</td>
<td>-</td>
<td>( 36 \frac{3}{4} )</td>
<td>( 36 \frac{3}{4} )</td>
<td></td>
</tr>
</tbody>
</table>
ACTIVITY SHEET

Subtracting Mixed Fractions with Unlike Denominators (Borrowing)

Subtract:

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

2. \(8 - 5 \frac{1}{2}\)

3. \(6 \frac{1}{3} - 4 \frac{2}{3}\)

4. \(25 \frac{3}{8} - 12 \frac{1}{2}\)

5. \(18 \frac{1}{3} - 9 \frac{1}{2}\)

6. \(56 \frac{1}{5} - 17 \frac{1}{3}\)

7. \(37 \frac{1}{8} - 26\)

8. \(62 \frac{1}{2} - 25 \frac{2}{3}\)

9. \(85 \frac{7}{10} - 19 \frac{4}{5}\)

10. \(67 \frac{3}{4} - 18 \frac{1}{2}\)
UNIT C
FRACTIONS

OBJECTIVE

You will be able to subtract fractions.

INTRODUCTORY INFORMATION

You need to be able to subtract fractions so you can solve various problems. You may need to find the number of hours worked, the number of words typed a minute, or the number of reams left before reordering.

PROCEDURE

Solve the following problems. Show your work.

QUESTIONS, PROBLEMS, AND/OR ACTIVITIES

1. One printing job required 54\(\frac{1}{2}\) hours, while a second printing job took 73\(\frac{3}{4}\) hours. How much more time was needed for the second job?

2. A student has 215\(\frac{1}{2}\) hours of shop work and 428\(\frac{3}{4}\) hours of related work. How many more hours must he work to get credit for 1,000 hours?

3. A printer has 3/4 of a ream of paper. He uses 1/3 of that amount. What fraction of a ream will he have left?

4. How many more hours will a printer need to work on Friday to complete a 40-hour week if he worked 32 3/4 hours on Monday, Tuesday, Wednesday, and Thursday?

5. A printing job took 75 3/4 hours to complete. Tom worked 41\(\frac{3}{4}\) hours. How many hours did Joe work on the job?
ACTIVITY SHEET

Multiplication of Fractions

Multiply:

1. $\frac{1}{4} \times \frac{1}{2} = \underline{}$  
10. $\frac{5}{12} \times \frac{1}{3} = \underline{}$

2. $\frac{1}{8} \times \frac{1}{3} = \underline{}$  
11. $\frac{1}{3} \times \frac{3}{5} = \underline{}$

3. $\frac{1}{5} \times \frac{1}{4} = \underline{}$  
12. $\frac{4}{5} \times \frac{2}{4} = \underline{}$

4. $\frac{1}{2} \times \frac{1}{10} = \underline{}$  
13. $\frac{3}{10} \times \frac{1}{3} = \underline{}$

5. $\frac{1}{10} \times \frac{1}{4} = \underline{}$  
14. $\frac{2}{3} \times \frac{1}{2} = \underline{}$

6. $\frac{1}{2} \times \frac{2}{5} = \underline{}$  
15. $\frac{5}{6} \times \frac{6}{7} = \underline{}$

7. $\frac{5}{6} \times \frac{7}{3} = \underline{}$  
16. $\frac{5}{6} \times \frac{3}{8} = \underline{}$

8. $\frac{7}{15} \times \frac{3}{4} = \underline{}$  
17. $\frac{6}{7} \times \frac{11}{12} = \underline{}$

9. $\frac{9}{10} \times \frac{3}{10} = \underline{}$  
18. $\frac{4}{5} \times \frac{7}{8} = \underline{}$
ACTIVITY SHEET

Changing Mixed Numbers to Improper Fractions

Work these exercises:

1. \[ 3 \frac{1}{4} = \quad \] 
2. \[ 7 \frac{1}{2} = \quad \] 
3. \[ 6 \frac{2}{5} = \quad \] 
4. \[ 9 \frac{1}{4} = \quad \] 
5. \[ 1 \frac{5}{8} = \quad \] 
6. \[ 4 \frac{7}{9} = \quad \] 
7. \[ 6 \frac{1}{8} = \quad \] 
8. \[ 2 \frac{1}{10} = \quad \] 
9. \[ 8 \frac{2}{3} = \quad \] 
10. \[ 12 \frac{3}{4} = \quad \]
Multiply the following (reduce all answers to lowest terms).

1. \( \frac{5}{6} \times 6 = \) 
2. \( \frac{3}{4} \times \frac{4}{5} = \) 
3. \( 10 \times 3 \frac{1}{2} = \) 
4. \( 2 \frac{1}{2} \times 2 = \) 
5. \( 9 \frac{1}{3} \times 1 \frac{7}{8} = \) 
6. \( 1 \frac{3}{4} \times 2 \frac{1}{2} \times 3 \frac{1}{7} = \) 
7. \( 1 \frac{1}{2} \times 4 \frac{2}{3} = \) 
8. \( 4 \frac{1}{5} \times 6 \times \frac{5}{7} = \) 
9. \( 2 \frac{1}{3} \times 3 \frac{1}{2} = \) 
10. \( 5 \frac{3}{5} \times \frac{7}{8} = \)
OBJECTIVE
You will be able to multiply fractions.

INTRODUCTORY INFORMATION
Many problems require you to know how to multiply fractions. For example, you may have to figure the number of hours worked in a week's time, or you may need to know the number of copies completed in an hour's time.

PROCEDURE
Solve the following problems. Show your work.

QUESTIONS, PROBLEMS, AND/OR ACTIVITIES

1. How many hours did Joe work if he worked 7 3/4 hours for five days?

2. If one book weighed 1 1/8 pounds when bound, how much would 1,555 books weigh?

3. A printer runs an average of 1,350 sheets an hour for 7 3/4 hours. How many sheets did he print?

4. If a ream of paper weighs 2 1/2 pounds, how much will 25 reams weigh?

5. What length sheet would be necessary to get four "cuts" for a job 5 1/2" in length?
Name______________________________

Division: Whole Number by a Common Fraction

1. $4 \div \frac{3}{4} = \underline{\hspace{2cm}}$

2. $3 \div \frac{2}{5} = \underline{\hspace{2cm}}$

3. $1 \div \frac{2}{3} = \underline{\hspace{2cm}}$

4. $6 \div \frac{2}{3} = \underline{\hspace{2cm}}$

5. $2 \div \frac{3}{10} = \underline{\hspace{2cm}}$

6. $10 \div \frac{4}{5} = \underline{\hspace{2cm}}$

7. $9 \div \frac{2}{3} = \underline{\hspace{2cm}}$

8. $7 \div \frac{3}{4} = \underline{\hspace{2cm}}$

9. $5 \div \frac{2}{3} = \underline{\hspace{2cm}}$

10. $12 \div \frac{3}{3} = \underline{\hspace{2cm}}$

11. $8 \div \frac{5}{3} = \underline{\hspace{2cm}}$

12. $6 \div \frac{5}{8} = \underline{\hspace{2cm}}$

13. $10 \div \frac{7}{8} = \underline{\hspace{2cm}}$

14. $15 \div \frac{2}{5} = \underline{\hspace{2cm}}$

15. $14 \div \frac{2}{7} = \underline{\hspace{2cm}}$

16. $6 \div \frac{3}{11} = \underline{\hspace{2cm}}$

17. $11 \div \frac{4}{8} = \underline{\hspace{2cm}}$

18. $13 \div \frac{7}{9} = \underline{\hspace{2cm}}$

19. $12 \div \frac{4}{11} = \underline{\hspace{2cm}}$

20. $10 \div \frac{7}{10} = \underline{\hspace{2cm}}$
Division: Common Fraction by a Common Fraction

1. \( \frac{4}{8} \div \frac{2}{8} = \) 

2. \( \frac{6}{7} \div \frac{3}{4} = \) 

3. \( \frac{5}{8} \div \frac{2}{5} = \) 

4. \( \frac{5}{7} \div \frac{3}{7} = \) 

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

6. \( \frac{2}{16} \div \frac{5}{16} = \) 

7. \( \frac{6}{7} \div \frac{1}{4} = \) 

8. \( \frac{5}{8} \div \frac{7}{10} = \) 

9. \( \frac{3}{4} \div \frac{3}{8} = \) 

10. \( \frac{5}{9} \div \frac{2}{3} = \) 

11. \( \frac{9}{10} \div \frac{2}{4} = \) 

12. \( \frac{5}{6} \div \frac{2}{3} = \) 

13. \( \frac{3}{8} \div \frac{3}{4} = \) 

14. \( \frac{5}{12} \div \frac{6}{15} = \) 

15. \( \frac{7}{12} \div \frac{21}{24} = \) 

16. \( \frac{6}{13} \div \frac{2}{26} = \) 

17. \( \frac{9}{10} \div \frac{2}{5} = \) 

18. \( \frac{11}{16} \div \frac{3}{8} = \) 

19. \( \frac{15}{17} \div \frac{30}{24} = \) 

20. \( \frac{15}{16} \div \frac{5}{8} = \)
Division: Mixed Number by a Common Fraction

1. \(4 \frac{1}{3} \div \frac{1}{2} = \) 
2. \(7 \frac{2}{3} \div \frac{1}{2} = \) 
3. \(8 \frac{1}{6} \div \frac{3}{8} = \) 
4. \(3 \frac{7}{9} \div \frac{2}{3} = \) 
5. \(2 \frac{6}{7} \div \frac{4}{5} = \) 
6. \(4 \frac{2}{7} \div \frac{7}{9} = \) 
7. \(2 \frac{10}{12} \div \frac{2}{3} = \) 
8. \(7 \frac{1}{5} \div \frac{6}{9} = \) 
9. \(5 \frac{2}{3} \div \frac{4}{5} = \) 
10. \(2 \frac{1}{5} \div \frac{1}{4} = \) 
11. \(3 \frac{1}{3} \div \frac{2}{5} = \) 
12. \(6 \frac{1}{4} \div \frac{2}{3} = \) 
13. \(1 \frac{1}{2} \div \frac{3}{5} = \) 
14. \(6 \frac{3}{4} \div \frac{2}{5} = \) 
15. \(3 \frac{1}{2} \div \frac{4}{5} = \) 
16. \(1 \frac{5}{8} \div \frac{2}{3} = \) 
17. \(5 \frac{3}{5} \div \frac{7}{10} = \) 
18. \(5 \frac{1}{2} \div \frac{7}{12} = \) 
19. \(3 \frac{3}{11} \div \frac{6}{11} = \) 
20. \(3 \frac{1}{12} \div \frac{10}{26} = \)
Name ________________________________

Division: Mixed or Whole Number by a Mixed Number

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

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

3. \(3 \div 2\frac{2}{3} = \) 

4. \(1\frac{7}{8} \div 1\frac{1}{3} = \) 

5. \(3 \div 1\frac{6}{8} = \) 

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

7. \(25 \div 1\frac{1}{4} = \) 

8. \(3\frac{1}{3} \div 1\frac{5}{6} = \) 

9. \(3\frac{1}{2} \div 1\frac{1}{8} = \) 

10. \(2\frac{1}{3} \div 1\frac{3}{4} = \) 

11. \(5\frac{1}{8} \div 2\frac{3}{4} = \) 

12. \(13\frac{2}{3} \div 8\frac{3}{4} = \) 

13. \(9 \div 2\frac{1}{2} = \) 

14. \(5\frac{1}{4} \div 2\frac{1}{2} = \) 

15. \(6 \div 1\frac{2}{3} = \) 

16. \(1\frac{2}{3} \div 2\frac{1}{3} = \) 

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

18. \(11 \div 1\frac{1}{10} = \) 

19. \(4\frac{6}{8} \div 1\frac{6}{32} = \) 

20. \(2\frac{9}{64} \div 1\frac{1}{3} = \)
ACTIVITY SHEET

Reading Decimals

Write the following correctly in words.

I.

(1) 2.10
(2) 0.25
(3) 0.01
(4) 0.5
(5) 5.05
(6) 0.74
(7) 0.8

(8) 28.50
(9) 0.023
(10) 0.005
(11) 0.019
(12) 2.03
(13) 3.7
(14) 0.0012

II.

(1) 0.7
(2) 1.2
(3) 1.03
(4) 0.08
(5) 0.32
(6) 1.6
(7) 0.70
(8) 0.023
(9) 7.33
(10) 4.36

(11) 3.000
(12) 10.250
(13) 8.6
(14) 7.01
(15) 6.42
(16) 05.600
(17) 0.4
(18) 0.05
(19) 0.500
(20) 2.35
### DECIMALS: ADDITION AND SUBTRACTION

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<td>(1)</td>
<td>34.58</td>
<td>+ 7.4</td>
<td>(2)</td>
<td>9.6</td>
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<tr>
<td>(5)</td>
<td>4.08 - 0.6 =</td>
<td></td>
<td>(6)</td>
<td>8.5 - 0.04 =</td>
</tr>
<tr>
<td>(7)</td>
<td>46 + 30.74 =</td>
<td></td>
<td>(8)</td>
<td>84.1 - 0.08 =</td>
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<tr>
<td>(9)</td>
<td>8,541.62 - 509 =</td>
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<td>(10)</td>
<td>245.73 - 0.63 =</td>
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<tr>
<td>(11)</td>
<td>58.10</td>
<td>+ 0.01</td>
<td>(12)</td>
<td>5,276</td>
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<td>(15)</td>
<td>17.6</td>
<td>- .15</td>
<td>(16)</td>
<td>342</td>
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<td>(19)</td>
<td>.90</td>
<td>- .08</td>
<td>(20)</td>
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OBJECTIVE

You will be able to add or subtract decimals with one, two, and three decimal places.

INTRODUCTORY INFORMATION

Adding and subtracting decimals helps us when we deal with money. For example, giving change or paying the correct amount for anything that we want to buy is important.

PROCEDURE

Solve the following problems. Be sure to show your work.

QUESTIONS, PROBLEMS, AND/OR ACTIVITIES

1. A printer worked 7.5 hours on Monday, 7.8 hours on Tuesday, 6.2 hours on Wednesday, 5.4 hours on Thursday, and 7.3 hours on Friday. What were the total hours for the week? __________

2. After checking the stock, a printer finds on hand: 11.5 reams of #20 paper, 4.75 reams of Hammermill, .25 ream of cover stock, 12.45 reams of #40 stock. What is the total number of reams on hand? __________

3. A company had a balance of $3,561.75 in a checking account. The company drew checks as follows: $21.63, $14.29, $609.28, and $176.39. The following amounts were deposited: $61.75, $100.25, $761.60, and $29.10. What is the new balance? __________
MULTIPLICATION OF DECIMALS

1. $22 \times 0.02$
2. $356 \times 0.04$
3. $17.5 \times 6$
4. $107.5 \times 0.5$
5. $4.3 \times 8.5$
6. $8.9 \times 1.2$
7. $0.07 \times 16$
8. $3.5 \times 1.4$
9. $5.6 \times 4.7$
10. $8.2 \times 6.7$
11. $1.6 \times 1.6$
12. $13.04 \times 10$
13. $33.5 \times 100$
14. $0.07 \times 10$
15. $57.5 \times 100$
16. $3.008 \times 1.2$
DIVISION OF A DECIMAL BY A WHOLE NUMBER

Divide the following and check by multiplication.

1. \( 4 \sqrt{.8} \)  
   \[ \frac{.8}{.2} \]
   \[ \frac{.8}{.2} \]
   \[ \frac{.8}{.2} \]

2. \( 4 \sqrt{.08} \)
   \[ \frac{.08}{.2} \]
   \[ \frac{.08}{.2} \]
   \[ \frac{.08}{.2} \]

3. \( 8 \sqrt{2.4} \)
   \[ \frac{2.4}{.8} \]
   \[ \frac{2.4}{.8} \]
   \[ \frac{2.4}{.8} \]

4. \( 8 \sqrt{.24} \)
   \[ \frac{.24}{.8} \]
   \[ \frac{.24}{.8} \]
   \[ \frac{.24}{.8} \]

5. \( 5 \sqrt{.2} \)
   \[ \frac{.2}{.8} \]
   \[ \frac{.2}{.8} \]
   \[ \frac{.2}{.8} \]

6. \( 5 \sqrt{.02} \)
   \[ \frac{.02}{.8} \]
   \[ \frac{.02}{.8} \]
   \[ \frac{.02}{.8} \]

7. \( 64 \sqrt{16} \)
   \[ \frac{16}{.8} \]
   \[ \frac{16}{.8} \]
   \[ \frac{16}{.8} \]

8. \( 3 \sqrt{6.9} \)
   \[ \frac{6.9}{.8} \]
   \[ \frac{6.9}{.8} \]
   \[ \frac{6.9}{.8} \]

9. \( 42 \sqrt{.986} \)
   \[ \frac{.986}{.8} \]
   \[ \frac{.986}{.8} \]
   \[ \frac{.986}{.8} \]

10. \( 21 \sqrt{73.5} \)
    \[ \frac{73.5}{.8} \]
    \[ \frac{73.5}{.8} \]
    \[ \frac{73.5}{.8} \]

11. \( 34 \sqrt{.0816} \)
    \[ \frac{.0816}{.8} \]
    \[ \frac{.0816}{.8} \]
    \[ \frac{.0816}{.8} \]

12. \( 30 \sqrt{.6750} \)
    \[ \frac{.6750}{.8} \]
    \[ \frac{.6750}{.8} \]
    \[ \frac{.6750}{.8} \]

13. \( 2 \sqrt{4.54} \)
    \[ \frac{4.54}{.8} \]
    \[ \frac{4.54}{.8} \]
    \[ \frac{4.54}{.8} \]

14. \( 35 \sqrt{9.45} \)
    \[ \frac{9.45}{.8} \]
    \[ \frac{9.45}{.8} \]
    \[ \frac{9.45}{.8} \]

15. \( 21 \sqrt{0.735} \)
    \[ \frac{0.735}{.8} \]
    \[ \frac{0.735}{.8} \]
    \[ \frac{0.735}{.8} \]
DIVISION OF A DECIMAL BY A DECIMAL

Divide and check by multiplication.

Example:

1. \(5.472 \div 0.06\)
2. \(3.28 \div 0.08\)
3. \(7.26 \div 12.1\)
4. \(0.03 \div 0.09\)
5. \(0.15 \div 4.5\)
6. \(0.9 \div 8.181\)
7. \(0.61 \div 178.8276\)
8. \(0.612 \div 12.08088\)
9. \(25.5 \div 50\)
10. \(2.1 \div 11.76\)
11. \(0.03 \div 15\)
12. \(2.1 \div 3.276\)
13. \(133.5 \div 8.9\)
14. \(7.605 \div 0.09\)
15. \(0.7 \div 22.855\)
16. \(9.2 \div 23\)
STUDENT ACTIVITY SHEET

UNIT D

DECIMALS

MATHEMATICS

OBJECTIVE

You will be able to divide decimals up to three decimal places in either or both the divisor and the dividend.

INTRODUCTORY INFORMATION

You must be able to divide decimals so you will be able to figure your hourly wage.

PROCEDURE

Solve the following problems. Show your work.

QUESTIONS, PROBLEMS, AND/OR ACTIVITIES

1. A printer's paycheck for one week was in the amount of $95.38. The printer worked 32.2 hours to earn that amount. What was the hourly wage?

2. A check for $180.60 was received for 60 hours' work. How much was earned in one hour?

3. A secretary earned $729.00 in 13.5 weeks. How much was earned in a week?

4. A printer purchased a printing press for $1,875.78. The down payment was $50 cash and the balance was in 11 monthly installments. How much would each installment be?
OBJECTIVE

You will be able to multiply two decimals with up to three decimal places in each.

INTRODUCTORY INFORMATION

You must be able to multiply decimals to figure the percentage of savings on any item and to figure sales tax.

PROCEDURE

Solve the following problems. Show your work.

QUESTIONS, PROBLEMS, AND/OR ACTIVITIES

1. Find the tax due on taxable income of $2,250.50 when the rate is 22%.

2. Find the savings of the following invoices: $73.40 less 10%; $84.50 less 20%; $140 less 25%.

3. What would the sales tax be at 5% if you bought a typewriter for $145.95?

4. What would 22.5 reams of paper cost if each ream cost $1.95?

5. A typewriter originally cost $289.65 but is on sale for 25% off. What is the savings?

6. A printer worked 40.5 hours at $3.95 an hour. How much was earned?
ACTIVITY SHEET

Round off the following numerals to the nearer 10.

1. 56
2. 347
3. 512
4. 208
5. 196
6. 425
7. 679
8. 344
9. 1,738
10. 8,073
ACTIVITY SHEET

Round off the following numerals to the nearer 100.

✓1. 273

2. 519

3. 861

4. 108

5. 735

✓6. 6,199

7. 3,425

8. 9,749

✓9. 10,321

10. 10,082
ACTIVITY SHEET

Round off the following numerals to the nearer 1000.

1. 4,389
2. 3,842
3. 2,791
4. 1,274
5. 929
6. 8,505
7. 6,100
8. 5,555
9. 7,743
10. 142,499
COMPARING DECIMALS

Which number is greater?

(1) .8 or .62?
(2) 1.5 or .15?
(3) .04 or .4?
(4) 3.82 or 3.816?
(5) This is a picture of a pipe:

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.72</td>
<td>3.63</td>
<td>3.75</td>
<td>3.70</td>
</tr>
<tr>
<td>cm</td>
<td>cm</td>
<td>cm</td>
<td>cm</td>
</tr>
</tbody>
</table>

Which number is smaller?

(3) .04 or .4?
(4) 3.82 or 3.816?

Which section is the thickest?

Group A
Encircle greater decimal:

.4 or .39
\checkmark .72 or .587
.9 or .084
.195 or .1849
.249 or .25

Group B
Encircle greater number:

3.8 or .38
.862 or 8.42
1.58 or .307
7.921 or 7.9209
2.45 or .253

Group C
Encircle small decimal:

.3 or .31
.60 or .06
.48 or .5
.8 or .799
\checkmark .0073 or .008

Group D
Encircle smaller number:

6.92 or .692
4.3 or 4.29
7.99 or 8.3
\checkmark 3.67 or 3.067
5.0846 or 5.08461
UNIT D

DECIMALS

OBJECTIVE

You will be able to compare the value of two decimals and to order decimals according to their value.

INTRODUCTORY INFORMATION

Knowing decimals increases your knowledge in handling money, understanding sizes, using tools, and working with percentages.

PROCEDURE

Arrange in order of size, beginning with the smallest size.

QUESTIONS, PROBLEMS, AND/OR ACTIVITIES

1. .03, .003, .3, 3.00
2. .56, 56.0, 5.60, .056
3. .15, .17, .03, .2
4. .08, 1.8, 6.1, .73
5. 1.39, 5.25, 25.55, .25
6. 4.66, 9.33, .93, 7.51
7. 8.05, 6.56, 7.56, .04
8. .51, .39, .109, .71
9. .49, 4.9, .18, 5.2
10. .09, 7.5, 6.9, .01
UNIT D
DECIMALS

OBJECTIVE
You will be able to read a decimal number and to write the decimal form for a fraction.

INTRODUCTORY INFORMATION
Decimals are an important part of everyday living. You use decimals in handling money and in telling time, among others.

PROCEDURE
Write the decimal form of the fractions below.

QUESTIONS, PROBLEMS, AND/OR ACTIVITIES
✓ 1. 1/4 dollar
✓ 2. 1/2 dollar
✓ 3. 3/4 dollar
4. 1/2 hour
5. 1/4 hour
6. 3/4 hour
✓ 7. 1/3 hour
8. 1/5 dollar
✓ 9. 2/3 hour
✓ 10. 1/10 dollar
OBJECTIVE

You will be able to change a decimal fraction to a common fraction.

INTRODUCTORY INFORMATION

You will find that certain measurements may sometimes be given as decimal parts in your office duplication class. When you are working with money, you will find it is always given in decimal amounts. These decimal parts may have to be changed to fractions to be of use to you.

PROCEDURE

Change each decimal to a fraction.

QUESTIONS, PROBLEMS, AND/OR ACTIVITIES

1. .15
2. .04
3. .0001
4. .025
5. .05
6. .0005
7. .010
8. .25
9. .02
10. .20
ACTIVITY SHEET

Changing Decimals to Percent

Change the following decimals to percent.

1) \(0.03 = \)____\%  
2) \(0.37 = \)____\%  
3) \(0.512 = \)____\%  
4) \(0.65 = \)____\%  
5) \(0.625 = \)____\%  
6) \(0.375 = \)____\%  
7) \(0.006 = \)____\%  
8) \(0.013 = \)____\%  
9) \(0.505 = \)____\%  
10) \(1.39 = \)____\%  
11) \(0.15 = \)____\%  
12) \(12.02 = \)____\%  
13) \(0.012 = \)____\%  
14) \(0.3 = \)____\%  
15) \(0.25 = \)____\%  
16) \(1.245 = \)____\%  
17) \(0.01 = \)____\%  
18) \(0.732 = \)____\%  
19) \(5.2 = \)____\%  
20) \(5.055 = \)____\%
ACTIVITY SHEET

Changing Percents to Decimals

Change the following percents to decimals.

1) 95%  
2) 100%  
3) 2%  
4) 34.2%  
5) 216%
UNIT E
PERCENT
Office Duplication
MATHEMATICS

OBJECTIVE
You will be able to find the percent form of a common fraction.

INTRODUCTORY INFORMATION
You need to be able to convert fractions to a percent to be able to find (1) your percent of profit and (2) percentage of time used to do a particular job.

PROCEDURE
1. \( \frac{1}{10} = \) _____
2. \( \frac{1}{2} = \) _____
3. \( \frac{1}{4} = \) _____
4. \( \frac{1}{5} = \) _____
5. \( \frac{3}{4} = \) _____
6. \( \frac{1}{20} = \) _____
7. \( \frac{3}{5} = \) _____
8. \( \frac{2}{5} = \) _____
9. \( \frac{3}{10} = \) _____
10. \( \frac{3}{20} = \) _____
11. \( \frac{7}{10} = \) _____
12. \( \frac{3}{50} = \) _____
13. \( \frac{7}{25} = \) _____
14. \( \frac{13}{20} = \) _____
15. \( \frac{27}{50} = \) _____
ACTIVITY SHEET

Changing Percents to Fractions

Change the following percents to fractions.

(2) 5\% = \\
(3) 100\% = \\
✓(4) 10\% = \\
(5) 75\% = \\
✓(6) 80\% = \\
✓(7) 40\% = \\
✓(8) 2\% = \\
(9) 33\% = \\
(10) 25\% =
OBJECTIVE

You will be able to solve the following types of problems:
(1) 5% of 90 = ____, (2) ____% of 100 = 30 and (3) 5% of _____ = 50.

INTRODUCTORY INFORMATION

You need to be able to figure percentage of a given number so that you will be able to find your percent of profit or cost.

PROCEDURE

Work the following problems.

QUESTIONS, PROBLEMS, AND/OR ACTIVITIES

1. 20% of ____ = 25
2. 80% of ____ = 60
3. 75% of ____ = 12
4. 40% of 110 = ______
5. 20% of 50 = ______
6. 10% of 50 = ______
7. 75% of 60 = ______
8. 45% of 80 = ______
9. ____% of 45 = 15
10. ____% of 8 = 2
Finding the Percentage of a Number

(1) 3% of 72 is what number?

(2) 7% of 163 is what number?

(3) What number is 25% of 96?

(4) What number is $37 \frac{1}{2}$% of 152?

(5) There are 20 pupils in a class. Sixty percent of the pupils are boys. How many are boys?

(6) One day 5% of the 20 pupils in Mrs. Moore's class made perfect scores on a spelling test. How many made perfect scores?

(7) Mr. McGill bought a new saw, regularly selling for $120, at a sale and saved 20%. How much did he save?

(8) The number of people at the game this week was 75% of what it was last week. Last week there were 800 people at the game. How many people were at the game this week?

(9) Thirty-six percent of 150 tickets have been sold. How many tickets have been sold?

(10) Last week there was a lot of illness. On one day only 65% of the 120 pupils in Poohick School were present. How many pupils were present?

(11) Four hundred square feet of tile has been ordered for tiling a room. If twenty percent of the amount purchased is allowed for waste and matching, how large an area can be tiled?

(12) An 8-track player originally sold for $86. Jim bought it for 40% off. What did he pay for the player?
Finding What Percent One Number Is of Another

1) 8 is what percent of 16?

2) 60 is what percent of 160?

3) What percent of 32 is 8?

4) $40 is what percent of $800?

5) $12 is what percent of $60?

6) A team played 50 games and won 25. What percent of the games did they win?

7) Bill answered 47 questions correctly on a test of 50 questions. What percent of the questions did he answer correctly?

8) In a class of 48 students, six were absent. What percent of the class was absent?

9) A store charged $240 for a refrigerator and made a profit of $43.20. What was the percent of profit?

10) A coffeemaker priced at $30 is reduced $10 in price. What is the percent of discount?

11) A quart of milk cost 10 cents in 1940. If a quart of milk cost 54 cents today, what is the percent of increase in price?

12) Mary bought a typewriter for $80 and sold it for $68. What is the percent of decrease?
ACTIVITY SHEET

Finding a Number When a Percent of It Is Given

Solve the following problems.

1. Fred has $360 in the savings bank now. This is 20% less than what he had in the bank a year ago. How much were his savings a year ago?

2. Mr. Jones sold 75% of his farm, and the number of acres sold was 150. How many acres did he originally own?
APPENDIX C

The business mathematics pretest/posttest is included in Appendix C.
BUSINESS MATHEMATICS EXAMINATION

Solve the following problems. Place your answer for each problem in the space provided. Do your work on the examination sheets.

1. Determine the total weekly sales for Andy Phillips:

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>M</td>
<td>T</td>
<td>W</td>
<td>TH</td>
<td>F</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td>----</td>
<td>---</td>
</tr>
<tr>
<td>$783.38</td>
<td>$537.21</td>
<td>$216.53</td>
<td>$91.46</td>
<td>$717.17</td>
</tr>
</tbody>
</table>

Answer

2. Calculate the total sales for these sales representatives:

<table>
<thead>
<tr>
<th>Name</th>
<th>Sales</th>
</tr>
</thead>
<tbody>
<tr>
<td>D. Calderon</td>
<td>$418.92</td>
</tr>
<tr>
<td>M. Chen</td>
<td>396.89</td>
</tr>
<tr>
<td>L. Moore</td>
<td>519.07</td>
</tr>
<tr>
<td>P. O'Ryan</td>
<td>216.50</td>
</tr>
<tr>
<td>F. Stewart</td>
<td>406.88</td>
</tr>
</tbody>
</table>

Answer

3. Find the savings for a desk chair which has a cash price of $95.17 and an installment price of $115.89.

Answer

4. If there are 55 lines of type on each page, how many lines will there be in a business report of 246 pages?

Answer

5. Compute the unit price for the following:

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Item</th>
<th>Unit Price</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>63</td>
<td>Calculator</td>
<td></td>
<td>$1,512</td>
</tr>
</tbody>
</table>

6. An employee typed the following number of business letters in a week:

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>M</td>
<td>T</td>
<td>W</td>
<td>TH</td>
<td>F</td>
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<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td>----</td>
<td>---</td>
</tr>
<tr>
<td>17</td>
<td>26</td>
<td>12</td>
<td>15</td>
<td>20</td>
</tr>
</tbody>
</table>

What was the average number of letters typed each day?

Answer
1. A student made the following grades during a week. What was his average grade?

91  86  86  93  95  84  78  80  97  90

Answer

8. \[ \frac{2}{10} + \frac{4}{10} = \]

9. \[ 4 \frac{2}{3} + 5 \frac{3}{5} + 2 \frac{1}{2} = \]

10. A secretary worked the following number of hours:

7  6 \frac{3}{4}  8 \frac{1}{4}  5 \frac{1}{2}  10

She worked a total of how many hours?

Answer

11. \[ \frac{5}{6} - \frac{1}{3} = \]

12. \[ 22 \frac{1}{3} - 17 \frac{3}{4} = \]

13. A clerk has \( \frac{2}{3} \) of a roll of tape. If he uses \( \frac{1}{2} \) of that amount, what fraction of a roll will he have left?

Answer

14. \[ 4 \times \frac{2}{8} = \]

15. A typewriter weighs 17 \( \frac{1}{3} \) pounds. How much would 5 such typewriters weigh?

Answer

16. How many hours did Dan work if he worked 8 \( \frac{3}{4} \) hours for 5 days?

Answer
17. \( \frac{2}{10} \div \frac{1}{4} = \) 

18. \( 6 \div \frac{1}{8} = \) 

19. \( 2 \frac{2}{3} \div 1 \frac{1}{6} = \) 

20. Write .6 in words. 

21. Write 2.05 in words. 

22. \( 14.02 + .17 + .6 = \) 

23. \( 518 - 16.25 = \) 

24. \( \$2.12 \times 8 = \) 

25. \( .012 \times .13 = \) 

26. A clerk earned \( \$1,166.75 \) in 6.5 weeks. How much was earned in a week? 

   Answer 

27. Round \( 21.743 \) to the nearest tenth. 

28. Round \( .0751 \) to the nearest hundredth. 

29. Which is larger, .3 or .03? 

30. Arrange in order of size beginning with the smallest: \( .41, .029, 1.08, .108, .7 \) 

   Answer 

31. Change \( \frac{3}{12} \) to a decimal equivalent.
32. Change $\frac{1}{5}$ to a decimal equivalent. _______

33. Change .04 to a fraction. _______

34. Change .7 to a fraction. _______

Change the following decimals to percents:
35. .005 = _______
36. .18 = _______
37. .036 = _______

Change the following percents to decimals:
38. 9% = _______
39. 33 $\frac{1}{3}$% = _______
40. 233% = _______

Change the following fractions to percents:
41. $\frac{2}{5}$ = _______
42. $\frac{6}{8}$ = _______

Change the following percents to fractions:
43. 30% = _______
44. 2% = _______

45. 5% of 40 = _______

46. What would the sales tax be at 6% if you bought a file cabinet at $239.49?

   Answer _______
47. 16 is what percent of 64? __________

48. A pen set priced at $45 is reduced $15. What is the percent of discount?

Answer __________

49. 1% of ____ = 8

50. An office products store sold 27 word processors. This was 60% of the stock. How many word processors were there originally?

Answer __________
APPENDIX D

Scores for all students are included in Appendix D. Numbers from one to thirty-eight are used to identify students in the lecture-demonstration group. Numbers thirty-nine to eighty are used to identify students in the individual study instructional group.
<table>
<thead>
<tr>
<th>Student Number</th>
<th>Mathematics Pretest</th>
<th>Mathematics Posttest</th>
<th>Ability Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>18</td>
<td>32</td>
<td>21</td>
</tr>
<tr>
<td>2</td>
<td>36</td>
<td>37</td>
<td>24</td>
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<td>3</td>
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APPENDIX E

The explanatory letter, response form and summary of the business mathematics review materials sent to the five panel members who were asked to establish validity for the business mathematics pretest/posttest are included in Appendix E.
Dear

During the fall semester, 1982, I will be conducting research with programmed instruction in practical mathematics for vocational office education students.

In order to conduct my study, it is necessary to validate the enclosed achievement pretest/posttest. As a member of a panel for this purpose, would you please examine this test and indicate whether you think the test will adequately determine whether a student can work problems in the mathematical areas involved in this study.

Enclosed is a summary of the program content for the four topics under examination to help you evaluate the pretest/posttest. It is important that you indicate yes or no for the entire test, but please indicate your reactions to individual items by marking the copy. Please return the evaluation in the enclosed envelope.

I am sincerely appreciative of the time and effort you have agreed to expend in behalf of this study.

Sincerely yours,

Verla Brown

Enclosures
PROGRAMMED INSTRUCTION FOR VOCATIONAL OFFICE EDUCATION
STUDENTS IN BUSINESS MATHEMATICS

Introduction—Four units, based upon Coordinated Vocational-Academic Education (CVAE) business mathematics materials, have been programmed for use by Vocational Office Education students. With the programmed material, students are provided explanations of business mathematics and are given relevant examples. Students are given related problems to work so that they can incorporate the principles they are studying. Practical business application is stressed throughout the four units. As students work through material and complete the problems, answers are provided for immediate feedback. Following each unit is a unit review and a unit test. The amount of time required to complete the four units is approximately six hours.

Numeration and Whole Numbers—Students are given numbers in word form and asked to write them in numerical form. The placement of the comma in numbers is explained. The material for whole numbers deals with a review of addition, vertical and horizontal; subtraction; multiplication; and division. Also included in this unit is finding the average (arithmetic mean) of a group of whole numbers. In this unit whole numbers are used in payroll records, delivery route records, and other types of business record keeping.

Fractions—The unit on fractions includes an introduction to fractions plus addition, subtraction, multiplication, and division of fractions. Fractions are used with practical business applications.

Decimals—Decimal fractions introduce this unit followed by addition, subtraction, multiplication, and division of decimals. Also included in this unit are the following: rounding off decimals, comparing the size of decimals, changing fractions to decimals, and changing decimals to fractions. Decimals are used in problems which have business applications.

Percents—The material in this unit on percents contains an introduction to percents, changing decimals to percents, changing percents to decimals, changing fractions to percents, and changing percents to fractions. These exercises are in preparation for the following: finding the percent of a number, finding what percent one number is of another, and finding a number when a percent of it is given. The problems related to percents have practical business applications.
PRETEST/POSTTEST

Will this test adequately determine whether a student can work problems in the mathematical areas involved in this study?

Yes ___  No ___
The explanatory letter and response form sent to three vocational office education advisory committees for further validation of the business mathematics review materials are included in Appendix F.
Dear

Enclosed are the programmed business mathematics materials for your perusal. These materials are to be used in the study I am conducting during the fall semester of 1982.

If the business mathematics review contained in these materials is applicable to business use, would you please indicate so on the attached form. If these materials are not applicable, please so indicate. If you feel these materials or any portion of them are not appropriate for business use, a brief explanation would be appreciated.

Since I am planning to conduct a pilot study using these materials the week of September 20, I would appreciate receiving your comments by September 16. You may make comments not only on the attached form but also on the copy of the materials.

I am sincerely appreciative of the time and effort you have agreed to expend in behalf of this study. If you would like a copy of the conclusions and recommendations of the study, please indicate so on the attached form.

Sincerely yours,

Verla Brown

Enclosures
BUSINESS MATHEMATICS REVIEW

The business mathematics review contains material applicable to business use.

The business mathematics review is material which is not applicable to business use.

General Comments:

Check if you wish to receive a copy of the conclusions and recommendations of this study.
BIBLIOGRAPHY

Books


Articles


Reports


Publications of Learned Organizations


Unpublished Materials


