To the Graduate Council:

I am submitting herewith a thesis written by Edward William Liskovec entitled "High School Seniors' Performance on a Test of Selected Consumer Mathematics Problems." I recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science, with a major in Business Education.

Betty J. Brown, Major Professor

We have read this thesis
and recommend its acceptance:

Accepted for the Council:

Vice Chancellor
Graduate Studies and Research

HIGH SCHOOL SENIORS' PERFORMANCE ON A TEST OF SELECTED CONSUMER MATHEMATICS PROBLEMS

A Thesis

Presented for the

Master of Science

Degree

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Edward William Liskovec

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ABSTRACT

The problem of this study was to identify selected consumer mathematics concepts, to develop an instrument for measurement of those concepts, and to determine the level of high school seniors' ability to solve problems using those concepts.

An outline of 40 items was constructed and two problems were written for each outline. Pilot Test I was constructed by using the 80 problems in four 20-problem tests. Pilot Test I, using open-ended questions, was administered to obtain distracters for multiple-choice items used in Pilot Test II. Pilot Test II was conducted to test the plausibility of the distracters. Pilot Test III was given to refine the items and determine the best items for inclusion in the final test.

In the construction of the final test only the best 35 of the original 80 items were used. The test was administered to 502 students in five high schools in Knoxville City and Knox County schools; however, only 442 of the students' answer sheets could be used in the analysis.

The final test was handscored and all answers were transferred to IBM cards. These IBM cards were used in the analysis of the study which was accomplished through the use of an SPSS-6 and SAS program.

The reliability coefficient of the test was .86, which met the criterion that it should not be below .80. The criterion for discrimination was that at least 50 percent of the items have indexes above .40; and 100 percent were to have indexes above .20. Seventy-seven percent of the items were above .40, with the remaining items between .20 to .40. The criterion for difficulty indexes was that at least 50 percent of the

items were to fall in the .40 to .70 range, with no items below .20 or above .80. Seventy-four percent of the items fell within the .40 to .70 range, with 89 percent in the .20 to .80 range. Only four items failed to meet the criterion.

Findings of the study revealed:

1. A significant difference was found between mean scores for male and female students in the entire sample of 442 students. Males scored significantly higher on the test than the females.

2. A significant difference was found between mean scores for college-bound and non-college-bound students in the entire sample. College-bound students scored significantly higher on the test than non-college-bound students.

3. High school seniors in this study could not solve consumer mathematics problems with a high degree of competence. Only 44.3 percent of the students correctly answered more than 65 percent of the test items.

TABLE OF CONTENTS

CHAPTER		PAGE
I.	THE PROBLEM	1
	Statement of the Problem	1
	Importance of the Study	2
	Analysis of the Study	5
	Definition of Terms	5
	Scope and Limitations	6
	Procedures	6
	Organization of the Study	8
II.	REVIEW OF RELATED LITERATURE	10
	History of Testing	10
	Criteria for Development of Good Tests	12
	Types of Tests	15
	Review of Research	16
	Other Related Literature	24
III.	THE CONSTRUCTION OF THE TESTS, POPULATION AND SAMPLE, AND ADMINISTRATION AND SCORING OF THE FINAL TEST	26
	Construction of the Tests	26
	Population and Sample	44
	Administration and Scoring of the Final Test	45
IV.	ANALYSIS OF THE FINAL TEST	47
	Reliability of the Test	47
	Index of Discrimination	47
	Index of Difficulty	50
	Differences Among Schools	52
	Differences Among Groups of Students	52
V.	FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS	57
	Findings	57
	Conclusions	58
	Recommendations	59
BIBLIOGRAPHY		60
APPENDICES		63
	Appendix A	64
	Appendix B	65
	Appendix C	81
VITA		89

LIST OF TABLES

TABLE		PAGE
I.	Indexes of Discrimination for Items in Alternate Forms of Pilot Test III	36
II.	Indexes of Difficulty for Items in Alternate Forms of Pilot Test III	38
III.	Outline of Consumer Problems and Final Test Items	40
IV.	Test Answers for Top 120 Students on Final Test	48
V.	Test Answers for Bottom 120 Students on Final Test	49
VI.	Difficulty and Discrimination Indexes for Final Test Items	51
VII.	Correct Responses on the Final Test of All Students, by School	53
VIII.	Correct Responses on the Final Test for Male and Female Students	55
IX.	Correct Responses on the Final Test for College-Bound and Non-College-Bound Students	56

CHAPTER I

THE PROBLEM

In a typical high school curriculum, the majority of courses in mathematics are college oriented with a small portion in vocational and general mathematics. The National Assessment of Educational Progress (NAEP) publication on mathematics[1] discloses that many young adults lack the basic mathematical concepts to function effectively as a consumer. Numerous students do not possess the basic math knowledge to compute the best buy in a grocery store on such items as rice or tuna fish. A similar mathematical inability is exhibited when students encounter mathematical problems relating to banking functions or taxation. These problems may be the result of many high school teachers and administrators believing that college-oriented mathematics will teach the students the concepts needed to solve consumer problems.

I. STATEMENT OF THE PROBLEM

The problem of this study was to identify selected consumer mathematics concepts, to develop an instrument for measurement of those concepts, and to determine the level of high school seniors' ability to solve problems using those concepts.

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[1] *Consumer Math, Selected Results from the First National Assessment of Mathematics* (Denver: National Assessment of Educational Progress, 1975).

II. IMPORTANCE OF THE STUDY

"Ninety-nine percent of America's 17-year-olds and 84 percent of young adults aged 26 to 35 can't balance a checkbook."[2] While this statement may be shocking, it is but one of many results reported by the National Assessment of Educational Progress (NAEP). The report, which had as its purpose the determination of the "mathematical skills needed by the American consumer to function effectively in the marketplace,"[3] is based on the results of consumer mathematics exercises given to 34,000 17-year-olds and 4,200 young adults. Results of the exercise reveal that young people were deficient in the following skills:

> ability to calculate percentages, discounts, and averages, to estimate unit prices at the store, to convert units of measure, and to read and interpret correctly graphs and tables used to present information in newspapers or magazines.[4]

Our "new generation" of youth is more interested in and concerned about consumer problems than previous generations.[5] Francis Lankford pointed out that:

> Everyone is a consumer of goods and services and, as such, must continually make decisions such as what, when and where to make purchases. . . . Lacking the capacity to examine possible choices objectively the consumer may

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[2]Art Branscombe, "Checkout on Consumer Math," *American Education*, October, 1975, p. 21.

[3]NAEP Report, p. xi.

[4]Branscombe, p. 21.

[5]Robert O. Herrmann, "Today's Young Adults as Consumers," *Journal of Consumer Affairs*, IV (Summer, 1970), p. 28.

> simply take the easy course of accepting the advice of persuasive advertising, or an aggressive salesman eager to exploit his victim's incompetence. . . .
> . . . . . .
> Consumer mathematics, then, makes its contribution to general education in the high school through a commitment to two general goals: (1) To develop capacity to analyze consumer alternatives and (2) to develop competency in the use of simple mathematics in making consumer decisions.[6]

Robert Herrmann stressed that:

> The new generation clearly needs consumer information and education. It is not well prepared for adult management roles either by its past experience or by training.[7]

His words are substantiated by the NAEP report which summarized these results:

> When the two groups were asked to compute the comparative costs of a square foot of floor space in two houses--with a total cost and total square footage given for each--only 21 percent of the 17-year-olds and 32 percent of the young adults could do it. . . .
> . . . . . .
> A different type of consumer problem is that of figuring out how much a parking lot, which charges 35 cents for the first hour and 25 cents for each additional hour or fraction thereof, should charge for a car left there from 10:45 a.m. until 3:05 p.m. The right answer--$1.35-- was calculated by 47 percent of the 17-year-olds and 57 percent of the young adults.
> When the same two groups were asked to calculate the correct taxi fare for a certain distance, though, the vast majority failed. Only ten percent of the 17-year-olds and 20 percent of the adults came up with the right answer.[8]

Mathematics professor Morris Kline stated:

> We are producing a generation of mathematical illiterates, kids who won't know enough about arithmetic to balance

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[6]Francis G. Lankford, Jr., "Consumer Mathematics in General Education of Secondary Schools," *The High School Journal*, LVIII (December, 1974), p. 79.

[7]Herrmann, p. 26.

[8]NAEP Report, pp. 2, 4, and 5.

> their checkbooks or figure out their income tax on the short form.[9]

Many educators agree with Kline that the "new" mathematics is responsible for the decline in mathematical aptitude. The arithmetic concepts taught in the seventh and eighth grades are reinforced by business math in high school have been replaced by "new" math, and the "courses of study are totally devoid of any aspects of consumer math."[10]

Lankford noted the current renewal of interest in consumer mathematics:

> The great reform movement in mathematics education for grades K-12 that featured the 1950's and the 1960's concentrated attention on the teaching of mathematics with little regard to its applications to consumer problems of the adult. Consequently, interest in consumer mathematics declined during these years. Now in the mid 1970's interest in this course is revived--stimulated in large measure by the widespread concern for problems of the consumer.[11]

However, Lewis commented that:

> Consumer mathematics has returned to the education scene. It shows every evidence of replacing general mathematics for the non-college-bound student and supplementing the "college preparatory" mathematics program as a fourth-year elective.[12]

Administrators and educators should recognize the significance of our present situation and take steps to reinforce the curriculum of

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[9]Morris Kline, *Why Johnny Can't Add: The Failure of New Math* (New York: St. Martin's Press, 1973), (as cited by Robert Schiller, "Where the 'New Math' Went Wrong," *Reader's Digest*, CV (September, 1974), pp. 110-111).

[10]Henry Lewis, "The 'New' Mathematics, Its Impact on Business Math," *Business Education World*, February, 1965, p. 34.

[11]Lankford, p. 81.

[12]Harry Lewis, "The Nature of the Consumer Mathematics Course," *The High School Journal*, LVIII (December, 1974), p. 93.

our secondary schools in a way that will assure that all youth have an opportunity to prepare themselves for the reality of life as a consumer. Educators should stress the basic consumer mathematics concepts necessary for our youth to make wise decisions in their role as consumers.

III. ANALYSIS OF THE STUDY

An analysis of the problem revealed that the following questions should be answered:

1. Is there a significant difference between the scores attained on a consumer mathematics test by male students and the scores of female students?

2. Can students who plan on post-secondary education solve consumer mathematics problems with a higher degree of accuracy than those students who will seek employment immediately after graduation?

3. At what level of competency can high school seniors solve consumer mathematics problems?

IV. DEFINITION OF TERMS

Two terms used extensively in this study are defined here.

Consumer. Any person who purchases a product or a service.

Consumer Mathematics. A course of study that incorporates the concepts of mathematics necessary to solve arithmetic problems involved in the purchase of consumer goods and services.

V. SCOPE AND LIMITATIONS

The test developed in this study was designed to measure only a portion of the problems individuals encounter as consumers. Only the problems involved with the topics found in Chapters 1 and 2 of the publication *Consumer Math--Selected Results from the First National Assessment of Mathematics*,[13] were used. Three pilot studies were conducted to develop the final instrument. Schools selected for pilot studies were not used in the final evaluation.

Students in the final evaluation were all seniors selected from five high schools in Knoxville City and Knox County Schools in Tennessee. Schools were selected that would provide a combination of income levels among the student bodies. Selection of students within each school was based on availability of seniors within classes. In one high school all the seniors present in school on the day of testing were used. The students in study hall were used in another school. In the remaining three schools students from social studies and business classes were used.

VI. PROCEDURES

This study involved the following major steps:

1. In order to answer the question, "What consumer mathematics problems are representative of the problems consumers encounter?" the researcher used the topics found in Chapters 1 and 2 of the publication

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[13] NAEP Report, p. iii.

Consumer Math, Selected Results from the First National Assessment of Mathematics.[14] An outline of consumer mathematics problems was constructed by assigning five subtopics to each of the eight main topics. This outline was reviewed by the researcher's graduate committee. Revisions of the outline were made as agreed upon by the committee.

2. From the test outline, 80 problems were constructed for the first pilot test. That test was constructed in a manner which would enable each participant to make computations in the space provided under each problem. This test was administered to 80 high school seniors in a Florida school.

3. The second pilot testing program used the incorrect answers on the first pilot test as distracters in two multiple-choice tests consisting of 40 items each. The second pilot test was administered to 129 high school seniors in the Knoxville area.

4. The third pilot test was constructed after each of the 40 items in the two previous tests used in the second pilot testing program was evaluated. Some items were reworded to increase clarity. A limited number of distracters were replaced because those distracters were not chosen by any students in previous pilot testing. The third set of tests was given to 100 high school seniors, in Jefferson County, Tennessee, with 50 students for each form of the test.

5. All of the items used in the pilot testing were analyzed to determine the best 35 problems for the final test. Although five of the outlines were deleted from the final test, each of the eight major

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[14] NAEP Report, p. iii.

headings found in Chapters 1 and 2 of the NAEP Report[15] was still represented by enough items to retain content validity for the test. Items were selected on the basis of difficulty and discrimination factors.

6. The final evaluation instrument was then administered to 502 students in five high schools. Schools participating in the final test were not used in any of the pilot testing. Students indicated on their answer sheet their sex and plans for post-secondary education.

7. Upon completion of the testing, answer sheets were screened to determine completeness. Sixty answer sheets were eliminated for incompleteness or because answers were provided by students other than seniors. The remaining 442 answer sheets were hand graded. IBM cards were used to record each student's choices on all 35 items, school code, sex code, and plans for post-secondary education.

8. Data were analyzed by SPSS-6 and SAS programs available through the University of Tennessee Computing Center to establish the reliability coefficient of the test, to compute the variance of scores among groups, and to compute *F* tests for significance of differences between groups. Other programs were run to determine difficulty and discrimination indexes and to provide scores for frequency distribution tables.

VII. ORGANIZATION OF THE STUDY

This study is divided into five chapters.

Chapter I includes the problem, importance of the study, analysis

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[15]NAEP Report, p. iii.

of the problem, definition of the terms, scope and limitations, procedures, and organization of the study.

Chapter II includes the history of testing, criteria for development of good tests, review of research, and other related literature.

Chapter III contains the construction of the tests, population and sample, and administration and scoring of the final test.

Chapter IV discusses the analysis of the results of the testing in secondary schools.

Chapter V contains the findings, conclusions, and recommendations.

CHAPTER II

REVIEW OF RELATED LITERATURE

No one really knows when testing began, but it has been used for thousands of years by man to measure achievement. This chapter includes the history of testing, criteria for development of good tests, types of tests, review of research, and other related literature.

I. HISTORY OF TESTING

Ebel credits the Chinese with the earliest testing program in 2357 B.C. The examination "formed the basis for admission and promotion in the civil service of ancient China."[1]

Stanley and Hopkins reported that:

> Oral questioning dates back to the beginnings of human language. Socrates (469?-399 B.C.) used it effectively to 'draw out' his students, as many good teachers do today, but it is important to distinguish between the instructional value of an activity and its evaluation merits. A spelling 'bee' may be useful as a motivation technique, but its measurement merits are few. Until the availability of inexpensive pencils and paper after the middle of the nineteenth century, oral examinations were standard in American schools. Some countries by law still require oral final examinations. American universities harbor vestiges of this in the form of 'thesis orals.'[2]

Horace Mann is usually credited with being instrumental in bringing the written testing program into education. When Mann was appointed

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[1]Robert L. Ebel, *Essentials of Educational Measurement*, Second Edition (Englewood Cliffs: Prentice-Hall, Inc., 1972), p. 5.

[2]Julian C. Stanley and Kenneth D. Hopkins, *Educational and Psychological Measurement and Evaluation* (Englewood Cliffs: Prentice-Hall, Inc., 1972), p. 156.

Secretary of the Massachusetts State Board of Education, he questioned the achievement level of public school students. To settle his argument with the disagreeing school masters and school committees, written tests were constructed in history, arithmetic, geography, definitions, grammar, science, and astronomy. The results of the tests "fully justified the criticisms by Mann."[3]

In 1903, Edward L. Thorndike published the first textbook in educational measurement. "He and his students produced many of the first scales for measuring educational achievements. The first standardized test of arithmetic was published by C. W. Stone in 1908."[4] Thorndike's efforts led Daniel Starch and E. C. Elliott to collaborate in 1912 studies to show that essay tests were poor measuring instruments.[5]

Intelligence tests were first introduced by French psychologist Alfred Binet in 1905. Binet, with his assistant Theodore Simon, published an improved version of the intelligence scale in 1908; however, intelligence testing was not used extensively until 1917 when Arthur Otis developed a test for the selection and classification of military personnel.[6]

Test development continued at a nominal pace from 1917 to 1945 with studies covering objective classroom testing, attitude measurement, educational development, and developed abilities.

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[3]Victor H. Noll and Dale P. Scannell, *Introduction to Educational Measurement*, Third Edition (Boston: Houghton Mifflin Company, 1972), p. 21.

[4]Ebel, p. 11. [5]Ebel, p. 12. [6]Ebel, p. 14.

Beginning with 1945, standardized testing became more evident. The creation of the Educational Testing Service in 1947 and the National Defense Education Act of 1958 each contributed to this increase. Obviously, the additional federal funds encouraged and stimulated many schools to inaugurate testing programs where none existed before. In 1965, Congress passed the Elementary and Secondary Education Act which provided funds for many experimental programs. It also put controls on testing by requiring "the use of objective measurement of educational achievement at least annually to evaluate the effectiveness of programs for educationally deprived children."[7]

The wide use of standardized testing has not gone unchallenged. Accusations have ranged from "inadequate" to "biased," "limited in scope," "invasion of privacy," etc. Educators have begun to examine the desirability of these tests and are decreasing the dependence they have previously placed on their results.[8]

II. CRITERIA FOR DEVELOPMENT OF GOOD TESTS

If a test is to be successful, careful planning must precede its construction. Construction of a good test requires considerable effort, knowledge, time and analysis. After the primary objective of the test is established, an outline is prepared, around which questions or problems are constructed.

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[7]Noll and Scannell, p. 37.

[8]Noll and Scannell, p. 40.

Most educators agree that the following characteristics are essential to a good test: validity, reliability, objectivity, ease of scoring, difficulty, and discrimination.

Validity

According to Ebel, "The term validity means the accuracy with which a set of test scores measures what it ought to measure."[9] Authors disagree on the number of types of validity, but most agree on these three: (1) Content validity--how adequately the content of the test samples the subject matter, (2) Construct validity--the extent to which goals are adapted to the content of the course, and (3) Predictive validity--the extent to which the scores on a test could predict performance at a later date.

Reliability

Reliability is the consistency with which a test measures whatever it does measure. Three methods of determining reliability are (1) split-halves, (2) test-retest, and (3) equivalent forms.

The desirable magnitude of reliability coefficients varies from author to author as it also varies in the type of test. A standardized test with a reliability coefficient of .90 or higher would be considered high, while a teacher-constructed test could be considered good if the reliability coefficient reached .70 or better.

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[9]Ebel, p. 435.

Objectivity

The extent to which competent persons agree on the scoring of answers on a test determines its objectivity. Noll and Scannell reported that:

> Objectivity is usually attained by (1) stating the questions specifically and precisely, (2) requiring specific, precise, short answers, and (3) scoring the test by the use of a previously determined scoring key.[10]

Ease of Scoring

Proper construction of a test includes ease of scoring. Three factors which will facilitate ease of scoring are (1) use of a key for scoring, (2) separate answer sheets, and (3) clear and simple directions.[11]

Difficulty

One of the marks of a good test is that items vary in difficulty to some extent. Obviously, if all items are either extremely difficult or easy, all scores would be either perfect or zero and, therefore, not a true measure of achievement. The difficulty index is the percent of some specified group who answer an item correctly.[12] Difficulty indexes with a range of .40 to .70 are considered by test experts to be within a standard range.

Discrimination

The discrimination power of an item is demonstrated by its ability to differentiate between students with considerable knowledge about a

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[10]Noll and Scannell, pp. 153-54.

[11]Noll and Scannell, pp. 156-157.

[12]Stanley and Hopkins, p. 450.

subject and those students with little knowledge. The index of discrimination is found by these steps: (1) Array the test scores in descending order, (2) determine the number of correct scores on an item by the students in the top and bottom 27 percent of the scores, (3) subtract the scores of the bottom 27 percent from the scores of the top 27 percent, and (4) divide the answer by the number in either the top or bottom 27 percent. Items with a discrimination index of .40 or higher are considered highly discriminatory. Moderate discrimination indexes range from .20 to .39.[13]

III. TYPES OF TESTS

Tests are divided into essay, objective, and problem types of tests. These three types are described below.

Essay Tests

The essay-type test consists of questions which the pupil answers by writing one or more paragraphs. The test items are easier to construct but more difficult to score than objective multiple-choice items. The essay-type test has probably been used longer than any other type of formal testing.

Objective Tests

Objective-type tests are usually of the true-false, short answer-completion, matching, or multiple-choice variety. The major advantage

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[13]Ebel, p. 399.

of objective tests is that if they are properly developed, they can be scored objectively. In reporting on multiple-choice items, Noll and Scannell commented:

> It is so generally regarded as the best and most widely applicable type of item that it has become the stock-in-trade, the basic type, for most standardized tests today.[14]

Problem Tests

The problem-type test is used widely in mathematics, some sciences, engineering, and a few other subjects. The major advantage of the problem test is that of "greater intrinsic relevance--of greater identity with on-the-job requirements--than either of the other types."[15] Problem testing, like essay testing, is limited in the number of sample items. Problem and multiple-choice testing were the types used in this study.

IV. REVIEW OF RESEARCH

Three research studies are reviewed in this chapter. Two of these studies involve test development and one is a major study in consumer mathematics.

Strunk Study

The purpose of the Strunk study[16] was to construct two valid and reliable insurance tests which could be used as either pretests or

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[14]Noll and Scannell, p. 223.

[15]Ebel, p. 101.

[16]Flonnie Strunk, "The Development of Valid and Reliable Insurance Tests for Secondary School General Business Classes" (unpublished Doctoral dissertation, The University of Tennessee, Knoxville, 1967).

posttests by high school general business teachers. Strunk constructed two tests which were to meet the following criteria:

1. The tests were to be easy to administer and to score.

2. The tests were to be objective.

3. The tests were to be valid.

4. The reliability coefficients for alternate forms and split-halves of the tests were to be at least .87.

5. The index of discrimination was to be .40 or higher for at least 50 percent of the items; .30 or higher for 75 percent of the items; .20 or higher for 90 percent; and .10 or higher for 95 percent of the items.

6. The indexes of difficulty of 50 percent of the items in the test were to fall within the range of .40 to .70.

7. The items in the two forms were to be similar in content, in discrimination, and in difficulty. The means of the forms were not to be significantly different at the .10 level of confidence.

8. The variation of scores of students in various schools was not to be significantly different at the .05 level of confidence.

A test outline of insurance principles and facts was developed from general business texts and supplementary insurance materials. A total of 226 multiple-choice items was constructed and sent to a jury of experts for evaluation to determine the content validity of the tests.

After each of the three pilot tests, items were revised or eliminated according to the index of discrimination of the item and the need for the item to maintain validity in the tests.

The correlation between Form X and Y was determined by the use of the split-halves method with the Spearman-Brown formula applied to determine the reliability for the whole test. The reliability criterion for the tests was set at .87. All tests were satisfactory, as reliability coefficients indicate: Pretest, Form X, .92; Form Y, .94; Posttest, Form X, .92; Form Y, .93.

The criteria for indexes of discrimination were 50 percent of the items with discrimination indexes above .40; 75 percent, above .30; 90 percent, above .20; and 95 percent, above .10. These criteria were not met in the pretest. The posttests were satisfactory, as 53 percent of the items in Form X and 65 percent of the items in Form Y were above .40.

The criterion index of difficulty of the items was 50 percent of the items within the range of .40 to .70. The pretest and posttests were both satisfactory.

The F ratio computed by analysis of variance of scores within the schools was significant at the .05 level, thereby failing to meet the criterion. The difference in the means of the two forms was found not to be significant at the .10 level; therefore, this criterion was met.

The Strunk study emphasized test construction and analysis. This study is related to the Strunk study in the procedures used for construction of test items, item analysis, and reliability testing.

Swayne Study

The problem of the Swayne study[17] was the construction of a filing test for high school vocational office education. An outline was constructed of the related-learning material to be covered by the filing test. The outline was presented to a committee of experts consisting of educators in the field of business education. Revisions of the outline were made as suggested by the panel. From this outline, 40 four-alternative, multiple-choice items were constructed covering the general procedures of filing, including principles applying to subject, geographic, and numeric filing. Another group of 70 questions was constructed covering the rules of alphabetic filing.

Pilot Test I, consisting of three divisions called Part X, Part Y, and Part Z, was administered by their regular teachers to 172 high school seniors enrolled in Vocational Office Education courses. Test papers were scored from a predetermined key, and an item analysis was made to establish discrimination and difficulty indexes for the items.

Pilot Test II was constructed using the items which met the established criteria in Pilot Test I. Those items not meeting the criteria were revised, checked against the outline for content validity, and then used in the construction of Part B of Pilot Test II. Pilot Test II was administered to 141 students in six secondary schools.

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[17]Ruth Mitchell Swayne, "A Construction of a Filing Test for High School Vocational Office Education" (unpublished Master's thesis, The University of Tennessee, Knoxville, 1970.

Analysis of the study revealed:

1. Validity for the test was obtained by constructing an outline covering the rules and procedures of filing and having the outline approved by a panel of experts.

2. In Part A, 66 percent of the items fell above .25 in discrimination (27 percent above .40). In Part B, 65 percent of the items were above .25 in discrimination and 40 percent were above .40 in discrimination. Parts A and B, Pilot Test II, met the criteria for discrimination as set for this study.

3. The criterion for difficulty indexes for the study was set at 50 percent of the items within the range of .40 to .70. Part A, with 57 percent of the items in the criterion range, met the criterion. Part B, with only 38 percent of the items in that range, failed to meet the criterion.

4. Reliability was established through the use of split-halves method, using the Spearman-Brown formula to predict the reliability of a lengthened test. The reliability criterion was set at .80. Neither Part A nor Part B met the criterion, as Part A had a reliability coefficient of .66, and Part B, .58.

The present study is related to the Swayne study in the procedures for developing the test items. Pilot test construction was similar, but the present study included three pilot tests. The present study, unlike the Swayne or the Strunk study, used the pilot studies only as a means for preparing the final evaluation instrument.

National Assessment of Educational Progress (NAEP) Report

One of the most thorough studies of student achievement is the National Assessment of Educational Progress Report, begun in 1964 and continuing through the present. The background of the National Assessment of Educational Progress Report and the Consumer Mathematics Test of the NAEP Report are reviewed below.

Background. The National Assessment of Educational Progress is an information-gathering project, administered by the U. S. Education Commission, that surveys the educational attainments of students and young adults. Tests in ten areas (art, career and occupational development, citizenship, literature, mathematics, music, reading, science, social studies, and writing) are given to individuals in four age groups (9, 13, 17 and young adults between the ages of 26 and 35) representing different geographical regions, races, and socio-economic levels. The test exercises are designed to measure instructional objectives on a broad level. Noel and Scannell pointed out that:

> The emphasis throughout is on 'criterion referenced' testing, i.e., on the measured proficiency of defined groups on specified tasks and not on comparison of performance with that of others or with norms.[18]

All tests are designed with utmost care and administered under carefully controlled conditions. As Noel and Scannell described the NAEP procedures:

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[18]Noll and Scannell, p. 39.

> The programs are outstanding in the care and imagination exercised in their design and implementation, soundness and importance of purpose, and the highest professional qualifications of those responsible for them.[19]

Results of tests are reported in terms of groups, such as regions of the United States, size and type of community, 17-year-olds, adults aged 26 to 35, blacks and whites, and parental education.

Consumer Mathematics Test of NAEP. The report on consumer mathematics used in this study is based on the selection results from the First National Assessment of Mathematics.[20] Exercises presented in Chapter 1, entitled "Determining Costs: Consumer Problems Involving Money," were concerned with problems involving the use of percents in calculating costs. Other problems involved figuring taxes, comparing prices, determining cost of specific units of time and distance, filling out an order blank, and balancing a checkbook. Chapter 2 included exercises solving household problems. Chapter 3 involved reading and interpreting graphs and tables. The exercises in Chapter 4 used the concepts of average and percent.

To prevent reading ability from affecting mathematics performance, the exercises in group packages were played to the respondents on a tape recorder. Individually administered exercises were usually read aloud by the interviewer.

Selected results from Chapter 1 and 2, the chapters selected for this study, revealed:

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[19]Noll and Scannell, p. 39.

[20]*Consumer Math, Selected Results from the First National Assessment of Mathematics* (Denver: National Assessment of Educational Progress, 1975).

1. On a cost-comparison problem involving the lowest price per ounce on different-sized packages of rice, only 40 percent of 17-year-olds and 45 percent of the adults selected the correct answer.

2. Only 1 percent of the 17-year-olds and 16 percent of the adults were able to solve the problem of balancing a checkbook.

3. When asked to compute the comparative costs of a square foot of floor space in two houses (total cost and square footage were given), only 21 percent of 17-year-olds and 32 percent of the adults could solve the problem.

4. Given the weight and cooking time per pound for a turkey, participants were asked to determine what time to put the turkey in the oven in order to have it ready by a certain time. Only 35 percent of the 17-year-olds and 42 percent of the adults answered correctly. Males scored 10 percentage points above females at age 17 and 8 percentage points above females at the adult level.

An overall evaluation of the report showed that males outscored females; blacks performed below the national average on virtually all exercises; the Southeast Region ranked lowest on the national level of performance, with the Northeast being the highest; and the greater the level of parental education, the better the results of participants.

The NAEP Report was the basis for establishing content for the present study. The outline developed in that report was used to develop items for test questions in this study.

V. OTHER RELATED LITERATURE

Two authors, Francis Lankford, Jr.[21] and Harry Lewis,[22] identified concepts important in consumer mathematics. These concepts, according to Lankford and Lewis, are those which consumers should possess in order to operate effectively in the market place.

Lankford listed the following items:

1. Budgeting finances to provide for transportation, housing, clothing, taxes, insurance, etc.

2. Interpreting data necessary in making decisions concerning renting or purchasing a house.

3. Developing the ability to test the reasonableness of computed answers by making estimates.

4. Increasing the vocabulary to comprehend words like depreciation, add-on interest, assessed value, etc.

5. Increasing ability to read carefully and know definitions of words.

6. Saving money by using cash method rather than time payments in purchasing expensive items.

Lewis wrote that among the many topics pertinent to the consumer, the following should be included:

1. Purchasing a car.

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[21] Francis G. Lankford, Jr. "Consumer Mathematics in General Education of Secondary Schools," *The High School Journal*, LVIII (December, 1974), pp. 79-85.

[22] Harry Lewis, "The Nature of the Consumer Mathematics Course," *The High School Journal*, LVIII (December, 1974), pp. 86-93.

2. Operating cost of a car.

3. Earnings and payroll deductions.

4. Comparison shopping.

5. Completion of Federal and State Income Tax Forms.

6. Banking problems involving deposit and withdrawal.

7. Insurance of many varieties.

8. Investment in stock and bonds.

9. Interpretation of numerals in tables.

The Lankford and Lewis articles were used in this study to determine some of the subtopics for the eight main topics of Chapters 1 and 2 of the NAEP Report, which were used to form the outline for consumer problems used in this study.

CHAPTER III

THE CONSTRUCTION OF THE TESTS, POPULATION AND SAMPLE, AND ADMINISTRATION AND SCORING OF THE FINAL TEST

The purpose of this study was to identify selected consumer mathematics concepts, to develop an instrument for measurement of those concepts, and to determine the level of high school seniors' ability to solve problems using those concepts. In order to measure the students' ability to solve the problems, pilot tests and a final test were constructed. This chapter outlines the procedures used in the construction of the tests, selection of the population and sample, and administration and scoring of the final test.

I. CONSTRUCTION OF THE TESTS

The procedure for construction of the pilot tests and final evaluation instrument included four steps: (1) identification of the criteria for the test, (2) construction of the test outline, (3) construction of the pilot tests, and (4) construction of the final evaluation instrument.

Criteria for Test Items

The criteria for the tests constructed in this study were validity, reliability, objectivity, ease of scoring, suitable difficulty indexes, and suitable discrimination indexes for individual items.

1. Validity--content validity was established by checking items against the test outline obtained from the Report on National Assessment

of Educational Progress for consumer mathematics.

2. Reliability--a reliability coefficient was computed by use of the split-halves method and application of the Spearman-Brown formula to the data on odd-even scores from the tests. An acceptable reliability coefficient was .80.

3. Objectivity--test items were to have specific short answers with no item having more than one correct answer. Each test item was to have a correct answer, and no nearly correct answers were accepted as correct.

4. Ease of Scoring--scoring was done by using a prepared key which allowed the scorer to quickly mark each incorrect answer through a punched scoring sheet.

5. Difficulty indexes--at least 50 percent of the items accepted for the final test were to fall in the .40 to .70 range, with no items below .20 or above .80.

6. Discrimination indexes--at least 50 percent of the items included in the final test were to have indexes above .40, and 100 percent were to have indexes above .20.

Construction of the Test Outline

The content in a consumer mathematics textbook[1] and a business mathematics textbook[2] (together with their accompanying workbooks and

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[1]Roswell Fairbank, Robert Schultheis, and Edwin Piper, *Mathematics for the Consumer*, Second Edition (Cincinnati: South-Western Publishing Company, 1975).

[2]Roswell Fairbank, Robert Schultheis, and Edwin Piper, *Applied Business Mathematics*, Tenth Edition (Cincinnati: South-Western Publishing Company, 1975).

published tests), the NAEP Report on Consumer Math,[3] and problems written by the researcher were used in the construction of the test items. Other textbooks were examined. However, since these texts failed to contain problems relative to the concepts in the test outline, none were used in item construction.

From the subject content of Chapters 1 and 2 of *Consumer Math, Selected Results from the First National Assessment of Mathematics*,[4] an outline was constructed. The two chapters contained eight main headings as follows: (1) cost and percentages, (2) measures of weight, length, and capacity, (3) measures of time and area, (4) use of proportions, (5) cost comparison, (6) taxes, (7) costs over time and distance, and (8) filling out an order blank and balancing a checkbook. For each of the main headings, five problems were written for a total of 40 outline items. Appendix A shows the source of the problems used in the test. The purpose of the outline was to make certain that test items would be constructed using the concepts found in the first two chapters of the NAEP Report, thereby obtaining validity in the tests.

The test outline was submitted to the researcher's graduate committee. The committee evaluated the material in the outline for adherence to the content of the NAEP Report.

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[3] *Consumer Math, Selected Results from the First National Assessment of Mathematics* (Denver: National Assessment of Educational Progress, 1975).

[4] NAEP Report, p. iii.

Construction of the Pilot Tests

Three pilot tests were constructed for the purpose of developing good test items for the final test. The three pilot tests are described below.

Pilot Test I. The purpose of Pilot Test I was to obtain distracters for the multiple-choice items to be used in the other pilot tests and the final evaluation. Pilot Test I included two problems for each of the 40 outline items. Each problem was consistent with the outline, and each set of two problems covered a single concept. Differences existed only in names and amounts used in each problem. The following example illustrates the procedure used. The outline item for one problem reads: "Calculate the amount to be paid by one person when the total price is to be shared by three people on an uneven percentage basis." The problems developed for this outline item were:

> The rent on a house shared by Tom, Dick, and Harry is $210 each month. Tom and Dick *each* pay 35 percent of the rent and the remainder is paid by Harry. How much money must Harry pay each month for his portion of the rent?

and

> The rent on an apartment shared by Barbara, Jane, and Sally is $240 each month. Barbara and Jane *each* pay 30 percent of the rent and the remainder is paid by Sally. How much money must Sally pay each month for her portion of the rent?

Four 20-question tests were constructed in open-ended form. Students were provided with space below each problem to calculate their

answer. A space marked "Answer _____" was provided at the end of each problem for the student's answer.

A total of 80 high school seniors in one high school completed the first pilot test. Twenty students were used for each of the four 20-question tests. Students were given 50 minutes to complete the test, and all students finished the test. The test was hand scored, and the wrong answers for each item were tallied.

Pilot Test II. The purpose of Pilot Test II was to provide feedback to the researcher concerning the plausibility of distracters assigned to each item. Two tests of 40 questions each, Forms 1 and 2, were constructed from the 80 questions used in Pilot Test I. In order to retain validity, each test covered all 40 content outline items.

Only those wrong answers that were *concept* errors in the first pilot test were retained for use in the second pilot test. Errors caused by using the incorrect mathematical procedure, such as adding when subtraction should have been used, were considered as concept errors. All the errors that were arithmetic errors, i.e. addition, division, multiplication, and subtraction, were discarded. Incorrect answers of the first pilot test were refined for inclusion as distracters in the revised test for the second pilot test. Allowing the students to write "I don't know" in the answer blank, if they felt they did not know the procedure for solving the problem, provided an escape for the students if they were not certain about the solution.

Item construction. Thought-provoking and problem-solving items are usually more time consuming than items measuring rote knowledge.

Therefore, fewer items were used to assure that this test would be a power test rather than a speed test.

In the construction of the stem for each item the following guidelines were used:

1. "The item should cover an important achievement and the stem should clearly and distinctly identify the task posed by the item."[5]

2. Avoid the use of negatively stated stems.[6]

3. Avoid the use of specific determiners such as "always" and "never."

4. Avoid using stems that reveal the answer to another item.[7]

5. Construct the items so that the stem contains the majority of the problem, with short responses.

6. To lessen confusion and to illuminate responses desired, underline key words.

All answers to test items in the pilot tests and the final evaluation were correct answers; at no time were nearly correct answers used as the correct choice of a question. Noll and Scannell stated that "in multiple-choice items the best or correct answer should be placed equally often in each possible position."[8] However, Ebel says:

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[5]Victor H. Noll and Dale P. Scannell, *Introduction to Educational Measurement*, Third Edition (Boston: Houghton Mifflin Company, 1972), p. 223.

[6]Robert L. Ebel, *Essentials of Educational Measurement*, Second Edition (Englewood Cliffs: Prentice-Hall, Inc., 1972), p. 215.

[7]Julian C. Stanley and Kenneth D. Hopkins, *Educational and Psychological Measurement and Evaluation* (Englewood Cliffs: Prentice-Hall, Inc., 1972), p. 251.

[8]Noll and Scannell, p. 228.

> Whenever the responses for an item form a quantitative or qualitative scale, they normally should be arranged in order of magnitude from smallest to largest or largest to smallest.[9]

In Pilot Test II, responses were placed in ascending order, and equal dispersion of answers was still maintained. Out of the 40 items on each test, position "a" contained 11 answers; "b" had 8 answers; "c" had 10 answers; and "d" was correct for 11 answers.

Distracters were taken from the incorrect answers given by students on the first pilot test. Some of the errors of students on that test were caused by these processes:

1. To find a certain percentage, the student divided instead of multiplying.

2. To find what percentage one number is of another, the student multiplied instead of dividing.

3. In a problem containing more than one step, the student stopped before completing all steps and chose that answer for only part of the steps.

4. Students used other incorrect mathematical operations which rendered incorrect answers but did not generate arithmetic errors.

5. "None of the above" was included as a response on some items; students chose that response over the correct response in some cases.

The purpose of Pilot Tests I and II was to supply plausible responses for test questions. In some cases, only three plausible distracters could be drawn from those pilot tests. In those few cases, "None of the above" was used as a distracter for the test question. In some cases,

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[9] Ebel, p. 224.

also, "None of the above" was the correct answer to the test question. In other cases, the correct answer was included as a distracter, so students had to be able to solve the problem correctly to choose the correct answer; the wording "None of the above" was not a clue that the correct answer was not given as a response.

Answer sheet. An answer sheet was constructed which asked the students, in selecting their answers, to "darken" the letter, a, b, c, or d, which corresponded to their selection.

Administration of the test. Pilot Test II was administered to 140 high school seniors in one high school. Eleven students failed to complete the test in the 50 minutes allowed for the test, and their scores were not considered. Form 1 was completed by 58 students and Form 2 by 71 students.

Revision of the items. The criterion set for determining plausible distracters was that at least three students must choose the distracter for it to qualify as plausible. In Form 1, only two items had distracters that did not qualify. In Form 2, three items had distracters that did not meet the criterion.

Test items which failed to meet the distracter criterion were revised. The following illustration is an example of how one item in Pilot Test II was revised:

If a city's property tax is $29 per $1,000 of assessed value, how much tax should be paid on property assessed at $14,000?

a. $ 406.00 (correct answer)

b. $ 482.76

c. $4,060.00

d. $4,827.20

Distracters were revised and rearranged as follows:

a. $ 48.28

b. $ 406.00 (correct answer)

c. $ 482.76

d. $4,060.00

An analysis of the new distracters reveals that distracter "a" was chosen when the student divided $14,000 by $29, misplaced the decimal, and rounded off the answer. Answer "b" was chosen when the student divided $14,000 by $1,000 and then multiplied $29 by $14. Distracter "c" was chosen when the student divided $14,000 by $29. Distracter "d" was chosen when the student used correct procedure to find the answer to the problem but misplaced the decimal.

Some items were revised to insure that students would not misinterpret them. The following illustration shows how one of these items was revised.

Initial stem of item 4:

An electric pump which normally sells for $80 is being sold at a sales price of $64. What percent are you saving by buying the pump at the sale price?

Revised stem of item 4:

An electric pump which regularly sells for $80 is being sold at a sale price of $64. What percent of the regular price are you saving by buying the pump at the sale price?

Pilot Test III. The purpose of Pilot Test III was to test the items to determine which would be most suitable for inclusion in the final evaluation. All of the original and revised items of Pilot Test II were used for Pilot Test III. In order to retain validity, Forms 1 and 2 each covered all 40 outline items. As with the other pilot tests, Pilot Test III was administered to students by their regular teachers. One hundred students in one high school participated in the test, with 50 students using From 1 and 50 students using Form 2. Forms 1 and 2 of Pilot Test III are shown in Appendix B.

Table I shows the index discrimination for each item in alternate forms of Pilot Test III. The criterion for discrimination was that at least 50 percent of the items were to have indexes above .40 and the remainder were to have indexes above .20. A review of the items in Table I reveals that in Form 1, items 1, 5, and 24 did not meet the criterion. In Form 2, items 4, 5, and 13 had a discrimination index too low to meet the criterion.

In Form 1, 65 percent of the discrimination indexes for items were above .40, another 27 percent were above .20, and 8 percent were below the established criterion. In Form 2, 82 percent of the discrimination indexes for items were shown above .40, 10 percent were .20 to .40, and 8 percent did not meet the criterion.

TABLE I

INDEXES OF DISCRIMINATION FOR ITEMS IN ALTERNATE FORMS OF PILOT TEST III

Item Number	Index of Discrimination	
	Form 1	Form 2
1	.07	.21
2	.50	.43
3	.50	.50
4	.21	.07
5	.00	-.07
6	.57	.71
7	.36	.43
8	.29	.57
9	.36	.57
10	.64	.21
11	.43	.50
12	.36	.57
13	.21	.14
14	.57	.57
15	.21	.71
16	.43	.50
17	.71	.50
18	.50	.57
19	.57	.57
20	.29	.50
21	.43	.57
22	.50	.86
23	.57	.57
24	.07	.29
25	.79	.57
26	.36	.64
27	.57	.36
28	.36	.43
29	.43	.64
30	.64	.79
31	.64	.64
32	.86	.64
33	.64	.50
34	.71	.50
35	.43	.50
36	.43	.71
37	.50	.71
38	.64	.71
39	.21	.64
40	.57	.64

Table II shows the range of difficulty indexes for items in alternate forms. The criterion for difficulty indexes was that at least 50 percent of the items were to be in the .40 to .70 range, with no items below .20 or above .80. No item in either of the forms failed to meet the criterion.

In Form 1, 87 percent of the items fell within the .40 to .70 range, with 8 percent between .20 and .40 and 5 percent within the range of .70 to .80. In Form 2, 75 percent of the items fell within the range of .40 to .70, with 8 percent between .20 and .40 and 17 percent within the range of .70 to .80.

Final Evaluation

The final instrument was a test to determine the level of high school seniors' ability to solve the selected consumer mathematics problems. This section describes the procedures used in the construction of the test and selection of the population.

Construction of the test. The pilot studies showed that in order to assure completion of the test within the time limit of one class period, 55 minutes, the number of items in the test should be limited to 35. Although five of the outline items were deleted from the final evaluation, each of the eight major headings found in Chapters 1 and 2 of *Consumer Math--Selected Results from the First National Assessment of Mathematics*[10] was still represented by enough items to retain content validity for the test.

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[10]NAEP Report, p. iii.

TABLE II

INDEXES OF DIFFICULTY FOR ITEMS IN ALTERNATE FORMS OF PILOT TEST III

Item Number	Index of Difficulty	
	Form 1	Form 2
1	.61	.75
2	.61	.57
3	.68	.68
4	.68	.54
5	.36	.25
6	.57	.64
7	.68	.57
8	.64	.71
9	.61	.64
10	.46	.46
11	.64	.46
12	.61	.57
13	.61	.43
14	.50	.71
15	.68	.57
16	.71	.75
17	.57	.54
18	.61	.57
19	.43	.71
20	.36	.54
21	.57	.36
22	.68	.57
23	.64	.57
24	.32	.36
25	.46	.50
26	.46	.68
27	.57	.75
28	.68	.57
29	.50	.54
30	.46	.54
31	.54	.61
32	.57	.46
33	.54	.75
34	.57	.68
35	.64	.68
36	.71	.64
37	.61	.57
38	.68	.50
39	.61	.54
40	.64	.68

Determination of the 35 items for the final evaluation was based on the difficulty and discrimination indexes of each item. Using the data gathered from Pilot Test III, items which registered the best discrimination and difficulty indexes were used. All items except two (one at .71 and the other at .75), fell within the difficulty range of .40 to .70. All items had a discrimination index above .40. The problems in Pilot Test III, Forms 1 and 2, which did not meet the criteria for discrimination and difficulty indexes were related to outline items 1, 4, 5, 13, and 24. Table III shows the outline items developed from the NAEP Report and the test items used to test those concepts covered by the outline. Because of the necessity to shorten the test so that students could complete the test items within the time available to them, as well as the necessity to include those items which met those criteria and eliminate those which did not meet the criteria, 35 items were used in the final test. However, the *concepts* of those outline items 1, 4, 5, 13, and 24 were tested by problems in the test that were directly related to other outline items. For example, the concept of percentages which is a part of outline items 1, 4, and 5 was tested in part by problems 9, 11, 18, 20, 29 and 33 in the final test. The concept of working with square feet was tested by problem 16. That concept was part of outline item 13. The concept of working with fractions in outline item 24 was tested by problems 2 and 15, which included fractions. Therefore, although 35 test items were used to test 40 outline items, the concepts included in those 40 outline items were sufficiently tested to retain the validity of the test. The answer sheet accompanying the test was constructed to supply the researcher with the student's grade

TABLE III

OUTLINE OF CONSUMER PROBLEMS AND FINAL TEST ITEMS

Consumer Problems Concepts*	Final Test Item Numbers
Costs and Percentages	
1. Determine the amount an item will cost if a percentage discount is used.	33
2. Figure the amount of additional sales tax a person must pay if the sales tax is increased by one percent.	9
3. Calculate the amount to be paid by one person when the total price is to be shared by three people on an uneven percentage basis.	13
4. Compute the percent saved if an item is purchased at a sale price.	11
5. Determine the price of an item when the total price and the percent of sales tax are known.	29
Measures of Weight, Length, and Capacity	
6. Determine how many dozen containers are necessary to package several items.	12
7. Subtract yards, feet, and inches from yards, feet, and inches.	14
8. Change a number of quarts into gallons where the result will be a mixed number.	2
9. Determine the unused portion, in pounds, of a fractionated part of a ton.	15
10. Find the number of yards necessary to make several items which are measured in inches.	24

TABLE III (Continued)

Consumer Problems Concepts*	Final Test Item Numbers
Measures of Time and Area	
11. Determine the time a meat must be placed into an oven in order to be baked at a certain hour.	26
12. Calculate the number of cans of paint necessary to cover a certain area.	25
13. Find the area in square feet of a rectangular area.	16
14. Figure the average of three times listed in hours and minutes.	23
15. Express the area of a room in square yards when dimensions are given in feet.	16
Use of Proportions	
16. Figure the weight of a part, if the weight of a whole is known.	1
17. Calculate the distance a car can travel based on past performance.	27
18. Find the number of gallons of gasoline necessary to make a trip, based on past performance.	35
19. Determine a person's pay if the rate remains the same but the hours are increased.	31
20. Compute the amount of commission to be received, based on a previous commission rate.	28
Cost Comparison	
21. Determine the amount of money saved, per ounce, by purchasing the least expensive item.	19
22. Compute the extra cost of buying major items on credit versus cash.	7

TABLE III (Continued)

Consumer Problems Concepts*	Final Test Item Numbers
23. Compare the cost of making home improvements yourself, as opposed to hiring professional help to do the same job.	17
24. Determine the lowest price per unit where fractions are involved.	2, 15
25. Calculate the cost of buying an item at a discount price versus the regular price.	33
Taxes	
26. Calculate the amount of property tax on a house of a certain value.	3
27. Determine the amount of sales tax when the unit price and the tax rate are given.	20
28. Compute the total purchase price of an item when the unit price and the tax rate are given.	18
29. Figure the amount of Social Security tax to be deducted from an individual's pay.	29
30. Compute the amount of income tax due when the adjusted gross income, the number of exemptions, and the tax rate are to be considered.	32
Costs Over Time and Distance	
31. Find the total cost of gasoline used by an auto in making a trip.	21
32. Determine the charge to be assessed for the use of a parking lot on an hourly basis.	34
33. Figure the total wages earned when time and one-half wages are paid.	22
34. Calculate the weekly salary when the annual salary is known.	4

TABLE III (Continued)

Consumer Problems Concepts*	Final Test Item Numbers
35. Compute the cost of a telephone call based on a specified rate over a certain length of time.	5
Filling Out an Order Blank and Balancing a Checkbook	
36. Determine the total price of an order where four items are listed on an order blank.	10
37. Figure the amount of sales tax to be added to the total purchase price on an order blank.	11
38. Calculate the new checkbook balance when a service charge has been assessed.	8
39. Determine the available bank balance on a bank statement when an issued check and a late deposit do not appear on the statement.	30
40. Figure the new checkbook balance when a deposit has been made and a check drawn on the same date.	6

*Source: National Assessment of Educational Progress: *Consumer Math, Selected Results from the First National Assessment of Mathematics*, pp. 1-15.

level (only seniors were used in this study), sex, and position regarding post-secondary education after graduation. A copy of the final instrument and the answer sheet used in the final evaluation is included in Appendix C.

II. POPULATION AND SAMPLE

Students used in the final evaluation were high school seniors selected from three Knoxville City and two Knox County high schools. The first step in this procedure was gaining permission from the superintendents of each school system to use the high school seniors in their schools for the test. Each superintendent approved the request, contingent on the approval of the principals and teachers of each of the schools involved.

Each of the five schools was visited and tentative testing dates were established. A week prior to the tentative dates for testing, all schools were contacted to confirm the dates. Only one school had to schedule the test on a date later than originally planned.

Schools were selected that would provide the researcher with students with varied socio-economic backgrounds. One school assembled all seniors to participate in the test. Another school allowed the researcher to use the students in the study hall for the test. One school used three social studies and two business classes. Two schools used five social studies classes to participate in the test.

An *initial* sample of 502 students participated in the test. Of this number, 11 did not complete the test, and 49 were not seniors, leaving a *final* sample of 442. School *1* had 73 completed tests; school *2*,

90; school *3*, 81; school *4*, 110; and school *5*, 88.

III. ADMINISTRATION AND SCORING OF THE FINAL TEST

The final test was administered by the researcher to the students in each of the participating schools and scored by the researcher.

Administration

Prior to each test day, test packets were prepared. A test packet consisted of the test, answer sheet, and two sheets of blank paper. Early on the day of the test the researcher met with the teachers of the students involved and established the time each class would take the test.

When the students were seated, the regular teacher introduced the researcher and passed out the test. The researcher made the following remarks to the students:

> The purpose of this test is to determine if high school seniors possess the math skills necessary to be effective consumers. The results of this test may be a determining factor in changing your school curriculum to make it more relevant to the real world. It is vitally important, therefore, that each student exert maximum effort in honestly trying to solve each problem. It is for this reason I have chosen your school, because you have always demonstrated that no matter what the task is, you will always do your best. Before you begin the test please answer the three questions on the top of the answer sheet. Paper has been provided for you to calculate the problems. Please do not write on the test booklet. When you select an answer, please darken the entire letter on the answer sheet with a pencil. Does anyone need a pencil? When you have finished the test, please turn in all the materials I have given you--you may commence the test.

Pencils and additional paper were provided if the student needed them.

Since the purpose of the study was to test students as a whole and not individual students, students were asked not to write their names on the answer sheets. However, to provide the researcher with a means of identifying which answer sheets were used by a particular school, each answer sheet was color coded with a marking pen as it was turned in.

Scoring

After eliminating the uncompleted answer sheets and those filled out by non-seniors, the 442 completed answer sheets were scored. All scoring was done by hand with the use of a predetermined answer key. The answer key was constructed by the following method: (1) The correct selections were darkened with a pencil on an answer sheet, (2) an 8 1/2- by 11-inch plastic sheet was placed over the answer sheet, and (3) the selections were punched out with a hand punch.

The plastic answer key was placed over each student's answer sheet and each time a space appeared that was not darkened, this space was marked with a colored marking pen. Each school's answer sheets were marked with different colors for identification purposes.

Upon completion of the hand scoring, the data from the answer sheets were transferred to an IBM card. The IBM cards were used to record each student's choices on all 35 items, school code, sex code, and plans for post-secondary education. A program was prepared to duplicate each card and then tally and record the number of correct responses on the duplicated card. The duplicated cards were then processed through an IBM sorter to select and tally the top 27 percent and bottom 27 percent of the scores. The correct responses for each item were tallied to provide the data necessary to determine the indexes of discrimination and difficulty.

CHAPTER IV

ANALYSIS OF THE FINAL TEST

A statistical analysis was made from the scores of the students participating in the final test. The gathered data provided a means of determining the reliability coefficient, the indexes of discrimination, the indexes of difficulty, differences among schools in the study, and differences among groups of students.

I. RELIABILITY OF THE TEST

To determine the reliability of the test the split-halves method was used and the Spearman-Brown formula applied to estimate the reliability of the whole test. The results of the analysis showed that the test had a reliability coefficient of .86. The criterion set for this study was that the reliability coefficient should not be below .80.

II. INDEX OF DISCRIMINATION

The discrimination index for each test item was figured by the following steps:

1. The 442 test scores were arrayed from high to low.

2. The test answers of the top 120 (27 percent) students were tallied as shown in Table IV.

3. The test answers of the bottom 120 (27 percent) students were tallied (see Table V).

TABLE IV

TEST ANSWERS FOR TOP 120 STUDENTS ON FINAL TEST

Item Number	Responses			
	A	B	C	D
1	2	117*	1	0
2	0	116*	0	4
3	2	111*	1	6
4	113*	0	5	2
5	1	1	0	118*
6	6	109*	4	1
7	2	0	1	117*
8	3	1	3	113*
9	109*	2	9	0
10	0	1	119*	0
11	1	0	118*	1
12	95*	12	2	11
13	0	112*	6	2
14	10	103*	0	7
15	1	104*	1	14
16	3	5	3	109*
17	1	4	109*	6
18	4	3	111*	2
19	100*	13	4	3
20	0	15	103*	2
21	2	4	0	114*
22	0	7	4	109*
23	3	4	106*	7
24	103*	6	0	11
25	105*	0	1	14
26	88*	6	2	24
27	10	103*	3	4
28	10	1	4	105*
29	27	88*	4	1
30	2	98*	4	16
31	92*	5	0	23
32	15	76*	18	11
33	8	4	102*	6
34	5	91*	6	18
35	3	109*	5	3

*Indicates correct answer.

TABLE V

TEST ANSWERS FOR BOTTOM 120 STUDENTS ON FINAL TEST

Item Number	Responses			
	A	B	C	D
1	10	86*	9	15
2	21	60*	22	17
3	12	64*	21	23
4	67*	17	22	14
5	21	8	5	86*
6	20	80*	16	4
7	10	6	20	84*
8	15	10	11	84*
9	36*	25	49	10
10	24	7	65*	24
11	37	19	44*	20
12	20*	28	36	36
13	23	32*	46	19
14	38	22*	14	46
15	32	33*	22	33
16	9	30	34	47*
17	9	29	45*	37
18	30	23	40*	27
19	32*	36	10	42
20	5	46	40*	29
21	28	20	24	48*
22	12	30	43	35*
23	13	16	18*	73
24	16*	15	38	51
25	38*	14	14	54
26	30*	20	41	29
27	29	37*	39	15
28	16	30	21	53*
29	29	45*	39	7
30	17	39*	29	35
31	33*	39	16	32
32	29	28*	38	25
33	26	29	28*	37
34	19	27*	39	35
35	23	39*	36	22

*Indicates correct answer.

4. The following formula was used to determine the discrimination index of each item:

$$DIS = \frac{\text{Number Correct in High Group} - \text{Number Correct in Low Group}}{\text{Number Sampled in High } or \text{ Low Group}}$$

For example, if 203 students answered a question correctly (117 in the top 27 percent of the entire group and 86 in the lower 27 percent), assuming that 120 students represented the top 27 percent and another 120 students represented the bottom 27 percent, the discrimination index would be computed as shown here:

$$DIS = \frac{(117 - 86)}{120} \qquad DIS = \frac{31}{120} = .26$$

The criteria for the study for discrimination were that at least 50 percent of the items have indexes above .40, and 100 percent were to have indexes above .20. Table VI lists the discrimination index for each of the 35 items in the final test. Seventy-seven percent of the indexes were above .40 with all of the remaining indexes between .20 to .40.

III. INDEX OF DIFFICULTY

The difficulty indexes were determined by applying the following formula:

$$DIF = \frac{\text{Number of Correct Answers in High and Low Groups}}{\text{Total Number in Both Groups}}$$

$$DIF = \frac{(117 + 86)}{240} = \frac{203}{240} = .85$$

TABLE VI

DIFFICULTY AND DISCRIMINATION INDEXES FOR FINAL TEST ITEMS

Item Number	No. of Correct Answers		Difficulty Index	Discrimination Index
	High Group	Low Group		
1	117	86	.85	.26
2	116	60	.73	.47
3	111	64	.73	.39
4	113	67	.75	.38
5	118	86	.85	.27
6	109	80	.79	.24
7	117	84	.84	.28
8	113	84	.82	.24
9	109	36	.60	.61
10	119	65	.77	.45
11	118	44	.67	.62
12	95	20	.48	.63
13	112	32	.60	.67
14	103	22	.52	.68
15	104	33	.57	.59
16	109	47	.65	.52
17	109	45	.64	.53
18	111	40	.63	.59
19	100	32	.55	.57
20	103	40	.60	.53
21	114	48	.68	.55
22	109	35	.60	.62
23	106	18	.52	.73
24	103	16	.50	.73
25	105	38	.60	.56
26	88	30	.49	.48
27	103	37	.58	.55
28	105	53	.66	.43
29	88	45	.55	.36
30	98	39	.57	.49
31	92	33	.52	.49
32	76	28	.43	.40
33	102	28	.54	.62
34	91	27	.49	.53
35	109	39	.62	.58

The criterion for the study for difficulty indexes was that at least 50 percent of the indexes were to fall in the .40 to .70 range, with no indexes below .20 or above .80. Table VI lists the difficulty index for each of the 35 items in this study. Seventy-four percent of the indexes fell within the .40 to .70 range, with 89 percent of the indexes within the .20 to .80 range. Only items 1, 5, 7, and 8, with a difficulty index of more than .80, failed to meet the criterion.

IV. DIFFERENCES AMONG SCHOOLS

In order to investigate possible differences among the selected schools on achieved scores, an analysis of variance test was employed. The mean scores of the students in the five schools were 22.0, 23.01, 22.28, 20.19, and 21.75. Table VII shows the array of scores for all students and the distribution of scores by school. The analysis of variance test resulted in an F value of 2.237, which was not significant at the .05 level of confidence.

V. DIFFERENCES AMONG GROUPS OF STUDENTS

Table VII shows the cumulative percentage of students responding correctly to each number of correct items. Six students, or 1.4 percent of the total in the study,were able to answer all 35 items correctly. One-half of the students answered 22 of the 35 items correctly. The lowest achievement score on the test was six of 35 items answered correctly. The mean score of all 442 students completing the test was 21.76. Fifty-four percent of the students' scores fell within the 45 to 65 percent range of accuracy, with scores of 16 through 23.

TABLE VII

CORRECT RESPONSES ON FINAL TEST OF ALL STUDENTS, BY SCHOOL

Total Correct Responses	Number Scoring at Each Level By School					Total	Cumulative Total	Cumulative Percentage
	1	2	3	4	5			
35	2	1	2	0	1	6	6	1.4
34	2	4	2	2	3	13	19	4.3
33	4	2	3	1	3	13	32	7.2
32	4	4	4	3	2	17	49	11.1
31	1	4	5	1	2	14	63	14.3
30	0	8	2	3	2	14	77	17.4
29	2	3	4	6	4	19	96	21.7
28	1	2	4	3	7	17	113	25.6
27	1	5	3	4	3	16	129	29.2
26	3	4	1	5	2	15	144	32.6
25	3	3	2	1	3	12	156	35.3
24	4	4	4	3	2	17	173	39.1
23	5	4	4	8	2	23	196	44.3
22	3	6	5	4	7	25	221	50.0
21	2	2	1	8	5	18	239	54.1
20	7	4	4	6	3	24	263	59.5
19	7	2	1	4	3	17	280	63.3
18	3	7	3	9	4	26	306	69.2
17	2	4	7	10	4	27	333	75.3
16	3	3	4	5	5	20	353	79.9
15	3	1	2	3	5	14	367	83.0
14	3	1	2	4	4	14	381	86.2
13	3	2	1	4	3	13	394	89.1
12	3	5	4	1	1	14	408	92.3
11	1	2	2	6	3	14	422	95.5
10	1	0	1	3	2	7	429	97.1
9	0	2	2	1	1	6	435	98.4
8	0	1	2	2	0	5	440	99.5
7	0	0	0	0	1	1	441	99.8
6	0	0	0	1	0	1	442	100.0
Total	73	90	81	110	88	442	442	100.00
Mean	22.0	23.01	22.28	20.19	21.75	21.76		
St. Dev.	6.76	7.11	7.58	6.51	7.11	7.04		

F Value: 2.237.
Not significant at the .05 level.

One-way analysis of variance was applied to the mean scores of students grouped by sex. The mean score of the 228 males in the study was 23.73; the mean score for the 214 females was 19.65. The resulting F value, 40.2, was significant at the .01 level of confidence. Table VIII shows the array of scores for male and female students and the cumulative percentages of correct responses. Seventy-eight male students, or 34.2 percent, were able to answer 28 or more items correctly; while only 35 female students, or 16.4 percent, did as well. Eighty-nine percent of the males answered 16 or more items correctly as compared with only 70.1 percent of the females making correct responses on 16 or more items.

One-way analysis of variance was also applied to the mean scores of students grouped by college-bound and non-college bound students. For 267 college-bound students, the mean score was 23.14; for the 175 non-college-bound students included in the study, the mean score was 19.65. The resulting F value of 27.52, was significant at the .01 level of confidence. Table IX shows the array of correct responses on the final test for college-bound and non-college-bound students. Eighty-seven college-bound students, or 32.6 percent, were able to answer 28 or more items correctly, while only 26 non-college-bound students, or 14.9 percent, did as well. Eighty-eight percent of the college-bound students answered 15 or more items correctly, while 75.4 percen t of the non-college-bound students correctly answered 15 or more of the items.

TABLE VIII

CORRECT RESPONSES ON THE FINAL TEST FOR MALE AND FEMALE STUDENTS

Total Correct Responses	Males			Females		
	Number	Cumulative Total	Cumulative Percentage	Number	Cumulative Total	Cumulative Percentage
35	4	4	1.8	2	2	1.0
34	10	14	6.1	3	5	2.3
33	9	23	10.1	4	9	4.2
32	11	34	14.9	6	15	7.0
31	10	44	19.3	4	19	8.9
30	10	54	23.7	4	23	10.7
29	14	68	29.8	5	28	13.1
28	10	78	34.2	7	35	16.4
27	8	86	37.7	8	43	20.1
26	8	94	41.2	7	50	23.4
25	9	103	45.2	3	53	24.8
24	9	112	49.1	8	61	28.5
23	15	127	55.7	8	69	32.2
22	17	144	63.2	8	77	36.0
21	10	154	67.5	8	85	39.7
20	10	164	71.9	14	99	46.3
19	7	171	75.0	10	109	50.9
18	13	184	80.7	13	122	57.0
17	9	193	84.6	18	140	65.4
16	10	203	89.0	10	150	70.1
15	5	208	91.2	9	159	74.3
14	3	211	92.5	11	170	79.4
13	3	214	93.9	10	180	84.1
12	5	219	96.1	9	189	88.3
11	7	226	99.1	7	196	91.6
10	1	227	99.6	6	202	94.4
9	0	227	99.6	6	208	97.2
8	1	228	100.0	4	212	99.1
7	0	228	100.0	1	213	99.5
6	0	228	100.0	1	214	100.0
Totals		228			214	
Mean Scores		23.73			19.65	

F Value: 40.2.
Significant at .01 level.

TABLE IX

CORRECT RESPONSES ON THE FINAL TEST FOR COLLEGE-BOUND AND NON-COLLEGE-BOUND STUDENTS

Total Correct Responses	College-Bound Students			Non-College-Bound Students		
	Number	Cumulative Total	Cumulative Percentage	Number	Cumulative Total	Cumulative Percentage
35	6	6	2.2			
34	13	19	7.1			
33	11	30	11.2	2	2	1.1
32	11	41	15.4	6	8	4.5
31	12	53	19.9	2	10	5.7
30	10	63	23.6	4	14	8.0
29	12	75	28.1	7	21	12.0
28	12	87	32.6	5	26	14.9
27	11	98	36.7	5	31	17.7
26	8	106	39.7	7	38	21.7
25	9	115	43.1	3	41	23.4
24	11	126	47.2	6	47	26.9
23	13	138	51.7	11	58	33.1
22	12	151	56.6	12	70	40.0
21	12	163	61.0	6	76	43.4
20	11	174	65.2	13	89	50.9
19	10	184	68.9	7	96	54.9
18	16	200	74.9	10	106	60.6
17	15	215	80.5	12	118	67.4
16	10	225	84.3	10	128	73.1
15	10	235	88.0	4	132	75.4
14	6	241	90.3	8	140	80.0
13	7	248	92.9	6	146	83.4
12	9	257	96.3	5	151	86.3
11	5	262	98.1	9	160	91.4
10	1	263	98.5	6	166	94.9
9	4	267	100.0	2	168	96.0
8				5	173	98.9
7				1	174	99.4
6				1	175	100.0
Totals		267	100.0		175	100.0
Mean Scores		23.14			19.65	

F Value: 27.52.
Significant at .01 level.

CHAPTER V

FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS

This chapter includes the findings, conclusions, and recommendations. The findings are based on the analysis of the data, the conclusions were drawn from the results of the findings, and the recommendations are based on the entire study.

I. FINDINGS

Based on the analysis of the data the following findings were reported:

1. No significant difference was found among mean scores of students in five schools at the .05 level of confidence, indicating the students in the five schools were fairly homogeneous. Therefore, no further comparison by school was made.

2. A significant difference was found between mean scores for male and female students in the entire sample of 442 students. That sample included 228 males and 214 females. An *F* test was used to test the significance of the difference between means of 23.73 for males and 19.65 for females. The resulting *F* value of 40.2 was significant at the .01 level of confidence, indicating that males scored significantly higher on the test than females.

3. A significant difference was found between mean scores for college-bound and non-college-bound students in the entire sample of 442 students. That group included 267 college-bound and 175 non-college-bound students. An *F* test was used to test the significance of

difference between mean scores of 23.14 for college-bound and 19.65 for non-college-bound students. The *F* value obtained from that computation, 27.52, was significant at the .01 level of confidence, indicating that college-bound students scored significantly higher on the test than non-college-bound students.

4. High school seniors in this study could not solve comsumer mathematics problems with a high degree of competence. Only 44.3 percent of the students correctly answered more than 65 percent of the test items. Therefore, 55.7 percent of the students lacked the ability to answer two-thirds of the test questions correctly. Approximately 25 percent of all students were unable to correctly answer 50 percent of the items on the test.

II. CONCLUSIONS

A careful study of the findings has allowed the researcher to draw the following conclusions:

1. The test developed in this study is a valid and reliable instrument for testing students' ability to solve selected consumer mathematics problems.

2. Male students in this study were able to solve selected consumer mathematics problems with a higher degree of accuracy than female students.

3. The college-bound students, planning post-secondary education, were able to solve the problems with a higher degree of accuracy than non-college-bound students.

4. In this study, only approximately 45 percent of the students answered 65 percent or more of the problems correctly. The seniors included in this study lacked the ability to solve the problems at a level considered by the researcher to be a satisfactory level of competence.

III. RECOMMENDATIONS

1. The test developed in this study should be expanded to encompass all concepts of consumer mathematics. A more comprehensive test could be used to measure competency in solving all types of consumer mathematics problems that may be encountered in the consumer world. Such a test could be used as a diagnostic measure in consumer mathematics classes.

2. The test used in this study can be used as a diagnostic test in a consumer mathematics course to give the teacher guidance in planning appropriate learning experiences.

3. Teachers and administrators in high schools can use the test developed in this study to determine the level of competency of their students in solving selected problems.

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APPENDICES

APPENDIX A

SUPPLEMENT TO OUTLINE OF CONSUMER PROBLEMS

Outline Item Number	Code of Source*	Outline Item Number	Code of Source*
1	2, p. 302	21	5, p. 1
2	5, p. 6	22	5, p. 2.
3	6	23	6
4	1, p. 387	24	6
5	6	25	1, p. 408
6	6	26	5, p. 3
7	6	27	1, p. 336
8	6	28	1, p. 336
9	6	29	1, p. 339
10	6	30	6
11	5, p. 12	31	2, p. 322
12	5, p. 14	32	5, p. 5
13	6	33	1, p. 105
14	6	34	6
15	6	35	6
16	5, p. 14	36	6
17	1, p. 317	37	6
18	1, p. 97	38	4, C1, p. 3
19	6	39	6
20	3, p. 59	40	4, C1, p. 3

*Definition of Code of Source Document:

1. Roswell Fairbank, Robert Schultheis, and Edwin Piper, *Applied Business Mathematics*. Tenth Edition. (Cincinnati: South-Western Publishing Company, 1975).

2. Roswell Fairbank, Robert Schultheis, and Edwin Piper, *Mathematics for the Consumer*. Second Edition. (Cincinnati: South-Western Publishing Company, 1975).

3. Workbook for *Mathematics for the Consumer* listed in 2. above.

4. Published Tests for 2 above.

5. NAEP Report.

6. Items developed by researcher.

APPENDIX B

CONSUMER MATH PILOT TEST III

FORM 1

Read each problem carefully. Make your calculations and select the answer of your choice. Indicate your choice by placing an "X" over the corresponding letter on the answer sheet.

1. A hardware store offers all local city employees a courtesy discount of 8 percent. Sharon Wright, a city clerk, buys a power mower priced at $89.95. How much does she pay for it? Round off your answer to the nearest cent.

   a. $71.96
   b. $82.75
   c. $82.76
   d. $89.23

2. A state changes its sales tax from 4 percent to 5 percent. How much *additional* sales tax would you now pay on a new car that costs $4,855?

   a. $ 48.55
   b. $194.20
   c. $242.75
   d. $485.50

3. The rent on an apartment shared by Barbara, Jane, and Sally is $240 each month. Barbara and Jane *EACH* pay 30 percent of the rent and the remainder is paid by Sally. How much money must Sally pay each month for her portion of the rent?

   a. $ 72.
   b. $ 80.
   c. $ 96.
   d. $168.

4. An electric range which regularly sells for $320 is advertised at a sale price of $208. What percent of the regular price are you saving by buying the range at the sale price?

   a. 35 percent
   b. 53 percent
   c. 65 percent
   d. 112 percent

5. The total price of a bus fare to Portland is $262.50, which includes the tax. Determine the price of the bus fare before the tax was added, assuming that the tax rate was 5 percent.

   a. $210.00
   b. $249.37
   c. $250.00
   d. $275.63

6. Golf balls are wrapped in boxes containing *three* golf balls. How many *dozen* boxes would you need for 2,448 golf balls?

   a. 68
   b. 204
   c. 816
   d. None of the above.

7. *Subtract* 6 yards, 2 feet, 6 inches from 12 yards, 1 foot, 8 inches.

   a. 5 yards, 2 feet, 2 inches.
   b. 5 yards, 4 feet, 2 inches.
   c. 5 yards, 9 feet, 2 inches.
   d. 6 yards, 1 foot, 2 inches.

8. Thirty-four quarts are equal to how many gallons?

   a. 8
   b. 8 1/2
   c. 17
   d. 136

9. In January, Tom purchased a ton of coal (2,000 lbs.). In March, he determined that he had used 4/5 of the coal. How many pounds of coal does Tom *have left*?

   a. 160
   b. 400
   c. 1,600
   d. None of the above.

10. How many yards of ribbon are needed to make 60 school badges if it takes 3 inches of ribbon to make one badge?

    a. 5
    b. 15
    c. 20
    d. 180

11. A ham is to be baked 30 minutes for each pound. If a ham weighing 10 pounds is to be done by 6:00 p.m., what time should it be put into the oven to bake?

    a. 1:00
    b. 3:00
    c. 5:30
    d. None of the above.

12. A quart of paint will cover about 90 square feet of surface area. The paint you are to use is sold in *quart cans only*. How many *quart cans* are needed to paint a room with four walls, each wall measuring 8 x 8 feet? Disregard any doors or windows.

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

13. Harold owns a vacant lot that measures 200 feet long and 90 feet wide. Determine the number of *square feet* in the lot.

    a. 580
    b. 1,500
    c. 1,800
    d. 18,000

14. On Monday, Andy worked 8 hours and 30 minutes; on Tuesday, 8 hours and 40 minutes; and on Wednesday, 6 hours and 50 minutes. Determine the *average* number of hours Andy worked during the three days.

    a. 7 hours and 33 minutes
    b. 7 hours and 40 minutes
    c. 8 hours even
    d. 24 hours even

15. Pat's Florida room is 28 feet long and 12 feet wide. How many square yards of carpeting will it take to cover her Florida room floor? (A square yard contains 9 square feet.)

    a. 7 8/9
    b. 112
    c. 336
    d. None of the above.

16. If there are 400 calories in 12 ounces of a certain food, how many calories are there in a three-ounce portion of that food?

    a. 99
    b. 100
    c. 133
    d. 1,200

17. At 48 miles an hour, how far will a car travel in 2 hours and 15 minutes?

    a. 96 miles
    b. 103 miles
    c. 108 miles
    d. None of the above.

18. A certain car travels 75 miles on 5 gallons of gasoline. At this rate, how many gallons are needed for a trip 180 miles long?

    a. 2.4 gallons
    b. 12. gallons
    c. 15. gallons
    d. 36. gallons

19. Bill was paid $12.60 for working 3 1/2 hours. At the same rate, how much should he be paid for working 5 hours.

    a. $18.
    b. $21.
    c. $63.
    d. None of the above.

20. Eddie's sales amounted to $16,800 for which he received a commission of $840. Based on the same commission rate, how much money would Eddie receive if his sales for the month totaled $22,000?

    a. $ 4,400.
    b. $11,000.
    c. $22,840.
    d. None of the above.

21. You are comparing the prices of two cans of corned beef hash. Brand "A" is a 14 ounce can priced at 70 cents. Brand "B" is a 24 ounce can priced at $1.08. How much per ounce would you save by buying the cheaper brand?

    a. .5 cents
    b. 4.5 cents
    c. 5. cents
    d. 38. cents

22. Wayne can buy furniture on the installment plan by paying $46 a month for 12 months. If the cash price is $500, how much more would Wayne pay for the furniture by buying it on the installment plan?

    a. $152.
    b. $466.
    c. $522.
    d. None of the above.

23. A carpenter offers to repair George's roof for $1,200. George determined that the cost of materials for the job amounted to 60 percent of the total price. If George purchased the materials for the same price and did the job himself, how much would it cost him?

    a. $300.
    b. $480.
    c. $720.
    d. None of the above.

24. Store "A" is selling peanuts priced at 5/6 lb. for $1.20. Store "B" is selling peanuts priced at 2/3 lb. for 90 cents. How much money *per pound* would you save by buying the cheaper brand?

    a. 9 cents
    b. 15 cents
    c. 30 cents
    d. 40 cents

25. The sales tag on a dress is marked "$25." As there is a slight flaw on the sleeve of the dress, the salesman offers you the dress at a 20 percent discount off the regular price. How much will the dress cost you at the reduced price?

    a. $ 5.00
    b. $21.87
    c. $23.75
    d. None of the above.

26. How much tax must Mr. Fletcher pay on his home, which is assessed at $9,300, if the tax rate is $27.40 per $1,000 of assessed value?

    a. $ 246.60
    b. $ 251.10
    c. $2,548.20
    d. None of the above.

27. Determine the amount of sales tax to be paid on a briefcase selling for $34.45, if the sales tax rate is 6 percent. Round off your answer to the nearest cent.

    a. $ .57
    b. $2.06
    c. $2.07
    d. $5.74

28. Compute the total cost of buying a suit for $125, if the sales tax rate is 4 percent.

    a. $ 5.00
    b. $130.00
    c. $156.25
    d. $500.00

29. Compute the Social Security Tax at 6.95 percent that should be deducted from Hale's pay if he earned $170. Round off answer to nearest cent.

    a. $ 11.81
    b. $ 11.82
    c. $118.15
    d. None of the above.

30. Mr. Green's adjusted gross income for 1975 was $14,500. He has four standard deductions of $750 each and his tax rate is 20 percent. Compute the amount of income tax due for the year.

    a. $ 575.
    b. $2,300.
    c. $2,750.
    d. $3,500.

31. Mr. Blake drives 616 miles and averages 22 miles per gallon of gasoline. At 55 cents a gallon, what did it cost Mr. Blake for the gasoline he used on the trip?

    a. $12.10
    b. $14.40
    c. $14.85
    d. $15.40

32. A parking lot charges 30 cents for the first hour and 20 cents for each additional hour or fraction of an hour. For a car parked from 11:05 in the morning until 4:50 in the afternoon, how much money should be charged?

    a. $1.20
    b. $1.80
    c. $2.30
    d. None of the above.

33. Ted works on a 40-hour-week basis at $3.90 an hour with time and a half for overtime. Last week he worked 49 hours. What were his total earnings for the week?

a. $156.00
b. $173.55
c. $191.10
d. $208.65

34. Sue's annual salary last year was $8,580. If she worked every week of the year, what was her average weekly salary?

a. $165.00
b. $171.60
c. $178.75
d. $715.00

35. If a long distance telephone call costs $1.80 for the first three minutes and 45 cents for each minute thereafter, what would a call of nine minutes cost?

a. $2.70
b. $5.40
c. $8.10
d. None of the above.

36. The following purchases are listed on an order blank: 4 lbs. cheese at 69 cents a lb., one dozen lemons at 82 cents a dozen, 3 lbs. stew meat at $1.60 a lb., and 2 lb. beef at $1.08 a lb. What is the total cost of the order?

a. $ 4.91
b. $ 5.01
c. $11.98
d. $12.98

37. In problem 36 above, what would the total price be if a 4 percent sales tax were added to the total price of the order? Round off your answer to the nearest cent.

a. $ 5.09
b. $ 6.18
c. $12.46
d. $16.98

38. Mary's checkbook balance on May 1 was $456.71. On May 2, her bank charged her account with a service charge of $2.37. What is Mary's new checkbook balance?

    a. $454.33
    b. $454.44
    c. $459.08
    d. None of the above.

39. At the end of June, your bank statement shows a balance of $341.25. Check #87, for $44.25 that you issued, has not been paid by the bank. A deposit of $40 was made too late to appear on the statement. Your available bank balance is:

    a. $337.00
    b. $341.25
    c. $357.00
    d. $425.50

40. Phil's check stub showed a balance of $821.18 on May 1. On the next day, he deposited $156.75 and wrote a check for $389 for a stereo. What should Paul's final balance be?

    a. $ 488.93
    b. $ 520.93
    c. $ 588.93
    d. $1,366.93

CONSUMER MATH PILOT TEST III

FORM 2

Read each problem carefully. Make your calculations and select the answer of your choice. Indicate your choice by placing an "X" over the corresponding letter on the answer sheet.

1. During a preseason sale in July, Bill Waddell purchased a winter coat at 20 percent off the regular price of $175. How much money did Bill *save* by purchasing the coat in July?

   a. $ 3.50
   b. $ 8.75
   c. $ 35.00
   d. $140.00

2. A state changes its sales tax from 4 percent to 5 percent. How much *additional* sales tax would you now pay on a new car that costs $3,960?

   a. $ 36.90
   b. $ 39.60
   c. $ 40.00
   d. $198.00

3. The rent on a house shared by Tom, Dick, and Harry is $210 each month. Tom and Dick *each* pay 35 percent of the rent and the remainder is paid by Harry. How much money must Harry pay each month for his portion of the rent?

   a. $ 30.
   b. $ 63.
   c. $ 70.
   d. $147.

4. An electric pump which regularly sells for $80 is being sold at a sale price of $64. What percent of the regular price are you saving by buying the pump at the sale price?

   a. 5 percent
   b. 16 percent
   c. 20 percent
   d. 80 percent

5. The price of air fare for an around-the-world trip is $2,160 (tax included). Determine the price of the air fare alone, if the tax rate charged was 8 percent.

   a. $1,987.20
   b. $2,000.00
   c. $2,087.20
   d. $2,332.80

6. David bought a truck load of apples weighing 2,304 pounds and packaged them in four-pound bags. How many *dozen* four-pound bags of apples did David get out of the truck load of apples?

   a. 191
   b. 576
   c. 768
   d. None of the above.

7. *Subtract* 5 yards, 1 foot, 7 inches from 6 yards, 2 feet, 6 inches.

   a. 1 yard, 0 feet, 9 inches
   b. 1 yard, 0 feet, 11 inches
   c. 1 yard, 1 foot, 11 inches
   d. None of the above.

8. Twenty-seven quarts are equal to how many gallons?

   a. 6 1/2
   b. 6 3/4
   c. 7
   d. 108

9. In January, Sam purchased a ton of coal (2,000 lbs.). In March, he determined that he had used 7/10 of the coal. How many pounds of coal does Sam *have left*?

   a. 286
   b. 600
   c. 667
   d. 1,400

10. How many yards of ribbon are needed to make 30 school officer badges if it takes 9 inches of ribbon to make one badge?

    a. 3 1/3
    b. 7 1/2
    c. 22 1/2
    d. 270

11. A turkey is to be baked 20 minutes for each pound. If a turkey weighing 12 1/2 pounds is to be done by 5:00 p.m., what time should it be put into the oven to bake?

    a. 12:50
    b. 1:10
    c. 2:50
    d. None of the above.

12. A gallon of asphalt paint will cover about 250 feet of surface area. This paint is sold in *gallon cans only*. How many *gallon cans* are needed to paint a driveway 48 feet long by 10 feet wide?

    a. 2
    b. 20
    c. 480
    d. None of the above.

13. Rita's back yard is 150 feet long and 80 feet wide. Determine the number of *square feet* in her back yard.

    a. 460
    b. 1,200
    c. 5,520
    d. 12,000

14. On Monday, Cindy slept for 8 hours and 45 minutes; on Tuesday, 8 hours and 25 minutes; and on Wednesday, 8 hours and 20 minutes. Determine the *average* number of hours of sleep *per day* Cindy received during the three days.

    a. 8 hours and 3 minutes
    b. 8 hours and 30 minutes
    c. 8 hours and 43 minutes
    d. 25 hours and 30 minutes

15. Carol's living room measures 18 feet in length and 12 feet in width. How many square yards of carpeting will it take to cover her living room floor? (A square yard equals 9 square feet.)

    a. 6.66
    b. 72
    c. 216
    d. None of the above.

16. If there are 300 calories in 9 ounces of a certain food, how many calories are there in a 3 ounce portion of that food?

    a. 99
    b. 100
    c. 900
    d. None of the above.

17. Nancy drives 36 miles in 45 minutes. At that rate, how far will she drive in one hour?

    a. 45 miles
    b. 48 miles
    c. 51 miles
    d. 75 miles

18. Roger can drive his car 88 miles on four gallons of gasoline. Assuming that he maintains this same rate, how much gasoline will be needed for a trip of 528 miles?

    a. 6 gallons
    b. 22 gallons
    c. 24 gallons
    d. 132 gallons

19. Bob received $40 for working 5 hours. If he continues to receive the same rate of pay, how much will he earn in 40 hours.

    a. $ 8.
    b. $ 320.
    c. $1,600.
    d. None of the above.

20. Charlie's sales amounted to $8,300 for which he received a commission of $581. Based on the same commission rate, how much money would Charlie receive if his sales for the month totaled $10,000?

    a. $1,428.57
    b. $1,721.17
    c. $7,000.00
    d. None of the above.

21. You are comparing the prices of two packages of rice. Brand "A" is 12 ounces of rice priced at 36 cents. Brand "B" is 24 ounces of rice priced at 60 cents. If you purchased the *least expensive* brand, how much would you *save per ounce*?

    a. 2.5 cents
    b. 3.0 cents
    c. 24.0 cents
    d. None of the above.

22. A new automobile can be bought for cash for $2,850 or on credit with a down payment of $400 and $80 a month for three years. How much *more* would a person pay by buying on credit rather than paying cash for the automobile?

    a. $ 30.
    b. $ 430.
    c. $1,490.
    d. None of the above.

23. A professional painter told Mr. Payne that he would paint Mr. Payne's house for $800. If Mr. Payne can paint the house himself, *at a savings* of 70 percent of the cost of the professional painter, how much will it *cost* him?

    a. $ 24.
    b. $ 56.
    c. $240.
    d. $560

24. Store "A" is selling beef priced at 3/4 lb. for $1.80. Store "B" is selling beef priced at 1/2 lb. for $1.50. How much money *per pound* would you save by buying the *least expensive* beef?

    a. 30 cents
    b. 60 cents
    c. 75 cents
    d. None of the above.

25. A swimsuit regularly sells for $13. Mrs. Fish bought the swimsuit at a 25 percent discount off the regular price. How much did Mrs. Fish pay for the swimsuit?

    a. $3.25
    b. $7.80
    c. $9.75
    d. None of the above.

26. If a city's property tax is $29 per $1,000 of assessed value, how much tax should be paid on property assessed at $14,000?

    a. $ 48.28
    b. $ 406.00
    c. $ 482.76
    d. $4,060.00

27. Determine the amount of sales tax to be paid on a watch selling for $24.95, if the sales tax rate is 4 percent. Round off your answer to the nearest cent.

    a. $ .96
    b. $ .99
    c. $1.00
    d. $6.24

28. Compute the *total cost* of buying a clock which sells for $18.40, if the sales tax rate is 5 percent.

    a. $ .92
    b. $19.30
    c. $19.32
    d. $22.08

29. Find to the *nearest cent* the Social Security Tax at 5.85 percent that should be deducted from Tim's pay if he earned $150.

    a. $ 8.77
    b. $ 8.78
    c. $ 25.64
    d. $141.22

30. Mr. Gray's adjusted gross income for 1975 was $12,220. He has three standard deductions of $750 each and his tax rate is 16 percent. Compute the amount of income tax due for the year.

    a. $ 623.13
    b. $1,955.20
    c. $4,205.20
    d. None of the above.

31. Mr. Wright drives 600 miles and averages 24 miles per gallon of gasoline. At 50 cents a gallon, what did it cost Mr. Wright for the gasoline he used on the trip?

    a. $ 12.00
    b. $ 12.50
    c. $ 25.00
    d. $125.00

32. A parking lot charges 35 cents for the first hour and 25 cents for each additional hour or fraction of an hour. For a car parked from 10:45 in the morning until 3:05 in the afternoon, how much money should be charged?

    a. $1.25
    b. $1.35
    c. $1.60
    d. None of the above.

33. Fox works on a 40-hour-week basis at $2.70 an hour with time and a half for overtime. Last week he worked 45 hours. What were his total earnings for the week?

    a. $108.00
    b. $121.50
    c. $128.25
    d. $182.25

34. Mr. West's annual salary was $26,520. If he worked every week of the year, what was his average weekly salary?

    a. $ 510.00
    b. $ 530.40
    c. $ 552.50
    d. $2,210.00

35. If a long distance telephone call costs $2.10 for the first three minutes and $.65 for each minute thereafter, what would a call of 11 minutes cost?

    a. $ 7.15
    b. $11.50
    c. $13.45
    d. None of the above.

36. The following purchases are listed on an order blank: 3 lbs. of cheese at 69 cents a lb., 2 dozen lemons at 82 cents a dozen, 4 lbs. stew meat at $1.60 a lb., and 1 lb. of beef at $1.80 a lb. What is the total cost of the order?

    a. $ 4.91
    b. $11.81
    c. $11.91
    d. $12.00

37. In problem 36 above, what would the total price be if a 5 percent sales tax were added to the order. Round off your answer to the nearest cent.

    a. $ 5.16
    b. $12.46
    c. $12.51
    d. $12.60

38. Mr. Brown's personal checkbook balance on June 1 was $1,139.46. On June 2, his bank charged his account with a service charge of $9.69. What is Mr. Brown's new checkbook balance?

    a. $1,128.77
    b. $1,129.80
    c. $1,149.15
    d. None of the above.

39. At the end of June, your bank statement showed a balance of $301.20. Check #67 for $34.75, that you had issued, has not been paid by the bank. A deposit of $25 was made too late to appear on the statement. Your available bank balance is:

    a. $241.45
    b. $291.45
    c. $291.95
    d. $326.20

40. Paul's check stub showed a balance of $821.18 on May 1. On the next day, he deposited $125.75 and wrote a check for $236 for a stove. What is Paul's final balance?

    a. $ 459.43
    b. $ 710.93
    c. $ 931.43
    d. $1,182.93

APPENDIX C

FINAL CONSUMER MATHEMATICS TEST

1. If there are 300 calories in 9 ounces of a certain food, how many calories are there in a 3 ounce portion of that food?

   a. 99 — DIF .75
   b. 100 — DIS .50
   c. 900
   d. None of the above.

2. Twenty-seven quarts are equal to how many gallons?

   a. 6 1/2 — DIF .71
   b. 6 3/4 — DIS .57
   c. 7
   d. 108

3. If a city's property tax is $29 per $1,000 of assessed value, how much tax should be paid on property assessed at $14,000?

   a. $ 48.28 — DIF .68
   b. $ 406.00 — DIS .64
   c. $ 482.76
   d. $4,060.00

4. Mr. West's annual salary was $26,520. If he worked every week of the year, what was his average weekly salary?

   a. $ 510.00 — DIF .68
   b. $ 530.40 — DIS .50
   c. $ 552.50
   d. $2,210.00

5. If a long distance telephone call costs $2.10 for the first three minutes and $.65 for each minute thereafter, what would a call of 11 minutes cost?

   a. $ 7.15 — DIF .68
   b. $11.50 — DIS .50
   c. $13.45
   d. None of the above.

6. Paul's check stub showed a balance of $821.18 on May 1. On the next day he deposited $125.75 and wrote a check for $236 for a stove. What is Paul's final balance?

   a. $ 459.43
   b. $ 710.93
   c. $ 931.43
   d. $1,182.93

   DIF .68
   DIS .64

7. Wayne can buy furniture on the installment plan by paying $46 a month for 12 months. If the cash price is $500, how much more would Wayne pay for the furniture by buying it on the installment plan?

   a. $152
   b. $466
   c. $522.
   d. None of the above.

   DIF .68
   DIS .50

8. Mary's checkbook balance on May 1 was $456.71. On May 2, her bank charged her account with a service charge of $2.37. What is Mary's new checkbook balance?

   a. $454.33
   b. $454.44
   c. $459.08
   d. None of the above.

   DIF .68
   DIS .64

9. A state changes its sales tax from 4 percent to 5 percent. How much *additional* sales tax would you now pay on a new car that costs $4,855?

   a. $ 48.55
   b. $194.20
   c. $242.75
   d. $485.50

   DIF .61
   DIS .50

10. The following purchases are listed on an order blank: 4 lbs. cheese at 69 cents a lb., one dozen lemons at 82 cents a dozen, 3 lbs. stew meat at $1.60 a lb., and 2 lbs. beef at $1.80 a lb. What is the total cost of the order?

    a. $ 4.91
    b. $ 5.01
    c. $11.98
    d. $12.98

    DIF .71
    DIS .43

11. In problem 10 above, what would the total price be if a 4 percent sales tax were added to the total price of the order? Round off your answer to the nearest cent.

a. $ 5.09
b. $ 6.18
c. $12.46
d. $16.98

DIF .61
DIS .50

12. Golf balls are wrapped in boxes containing *three* golf balls. How many *dozen* boxes would you need for 2,448 golf balls?

a. 68
b. 204
c. 816
d. None of the above.

DIF .57
DIS .57

13. The rent on a house shared by Tom, Dick, and Harry is $210 each month. Tom and Dick *each* pay 35 percent of the rent and the remainder is paid by Harry. How much money must Harry pay each month for his portion of the rent?

a. $ 30.
b. $ 63.
c. $ 70.
d. $147.

DIF .68
DIS .50

14. *Subtract* 5 yards, 1 foot, 7 inches from 6 yards, 2 feet, 6 inches.

a. 1 yard, 0 feet, 9 inches
b. 1 yard, 0 feet, 11 inches
c. 1 yard, 1 foot, 11 inches
d. None of the above.

DIF .57
DIS .43

15. In January, Sam purchased a ton of coal (2,000 lbs.). In March, he determined that he had used 7/10 of the coal. How many pounds of coal does Sam have left?

a. 286
b. 600
c. 667
d. 1,400

DIF .64
DIS .57

16. Carol's living room measures 18 feet in length and 12 feet in width. How many square yards of carpeting will it take to cover her living room floor? (A square yard equals 9 square feet.)

a. 6.66 DIF .57
b. 72 DIS .71
c. 216
d. None of the above.

17. A professional painter told Mr. Payne that he would paint Mr. Payne's house for $800. If Mr. Payne can paint the house himself, *at a savings* of 70 percent of the cost of the professional painter, how much will it *cost* him?

a. $ 24. DIF .57
b. $ 56. DIS .57
c. $240.
d. $560.

18. Compute the *total cost* of buying a clock which sells for $18.40, if the sales tax rate is 5 percent.

a. $ .92 DIF .57
b. $19.30 DIS .43
c. $19.32
d. $22.08

19. You are comparing the prices of two cans of corned beef hash. Brand "A" is a 14 ounce can priced at 70 cents. Brand "B" is a 24 ounce can priced at $1.08. How much per ounce would you save by buying the cheaper brand?

a. .5 cents DIF .57
b. 4.5 cents DIS .43
c. 5. cents
d. 38. cents

20. Determine the amount of sales tax to be paid on a briefcase selling for $34.45 if the sales tax rate is 6 percent. Round off your answer to the nearest cent.

a. $ .57 DIF .57
b. $2.06 DIS .57
c. $2.07
d. $5.74

21. Mr. Blake drives 616 miles and averages 22 miles per gallon of gasoline. At 55 cents a gallon, what did it cost Mr. Blake for the gasoline he used on the trip?

a. $12.10
b. $14.40
c. $14.85
d. $15.40

DIF .54
DIS .64

22. Ted works on a 40-hour-week basis at $3.90 an hour with time and a half for overtime. Last week he worked 49 hours. What were his total earnings for the week?

a. $156.00
b. $173.55
c. $191.10
d. $208.65

DIF .54
DIS .64

23. On Monday, Andy worked 8 hours and 30 minutes; on Tuesday, 8 hours and 40 minutes; and on Wednesday, 6 hours and 50 minutes. Determine the *average* number of hours Andy worked during the three days.

a. 7 hours and 33 minutes
b. 7 hours and 40 minutes
c. 8 hours even
d. 24 hours even

DIF .50
DIS .57

24. How many yards of ribbon are needed to make 60 school badges if it takes 3 inches of ribbon to make one badge?

a. 5
b. 15
c. 20
d. 180

DIF .46
DIS .64

25. A gallon of asphalt paint will cover about 250 feet of surface area. This paint is sold in *gallon cans only*. How many gallon *cans* are needed to paint a driveway 48 feet long by 10 feet wide?

a. 2
b. 20
c. 480
d. None of the above.

DIF .57
DIS .57

26. A turkey is to be baked 20 minutes for each pound. If a turkey weighing 12 1/2 pounds is to be done by 5:00 p.m., what time should it be put into the oven to bake?

a. 12:50
b. 1:10
c. 2:50
d. None of the above.

DIF .46
DIS .50

27. Nancy drives 36 miles in 45 minutes. At that rate, how far will she drive in one hour?

a. 45 miles
b. 48 miles
c. 51 miles
d. 75 miles

DIF .54
DIS .50

28. Charlie's sales amounted to $8,300 for which he received a commissio of $581. Based on the same commission rate, how much money would Charlie receive if his sales for the month totaled $10,000?

a. $1,428.57
b. $1,721.17
c. $7,000.00
d. None of the above.

DIF .54
DIS .50

29. Find to the *nearest cent* the Social Security Tax at 5.85 percent that should be deducted from Tim's pay if he earned $150.

a. $ 8.77
b. $ 8.78
c. $ 25.64
d. $141.22

DIF .54
DIS .64

30. At the end of June, your bank statement showed a balance of $301.20. Check #67 for $34.75, that you had issued, has not been paid by the bank. A deposit of $25 was made too late to appear on the statement. Your available bank balance is:

a. $241.45
b. $291.45
c. $291.95
d. $326.20

DIF .54
DIS .64

31. Bill was paid $12.60 for working 3 1/2 hours. At the same rate, how much should he be paid for working 5 hours?

a. $18.
b. $21.
c. $63.
d. None of the above.

DIF .43
DIS .57

32. Mr. Green's adjusted gross income for 1975 was $14,500. He has four standard deductions of $750 each and his tax rate is 20 percent. Compute the amount of income tax due for the year.

a. $ 575.
b. $2,300.
c. $2,750.
d. $3,500.

DIF .46
DIS .64

33. A swimsuit regularly sells for $13. Mrs. Fish bought the swimsuit at a 25 percent discount off the regular price. How much did Mrs. Fish pay for the swimsuit?

a. $3.25
b. $7.80
c. $9.75
d. None of the above.

DIF .50
DIS .57

34. A parking lot charges 35 cents for the first hour and 25 cents for each additional hour or fraction of an hour. For a car parked from 10:45 in the morning until 3:05 in the afternoon, how much money should be charged?

a. $1.25
b. $1.35
c. $1.60
d. None of the above.

DIF .46
DIS .64

35. A certain car travels 75 miles on 5 gallons of gasoline. At this rate, how many gallons are needed for a trip 180 miles long?

a. 2.4 gallons
b. 12. gallons
c. 15. gallons
d. 36. gallons

DIF .61
DIS .50

CONSUMER MATHEMATICS ANSWER SHEET

Grade level: 10 11 12
(Circle one)

Sex: Female Male
(Circle one)

Are you going to college next year? Yes No
(Circle one)

COMPLETELY BLACK OUT YOUR ANSWER

1.	a.	b.	c.	d.	19.	a.	b.	c.	d.
2.	a.	b.	c.	d.	20.	a.	b.	c.	d.
3.	a.	b.	c.	d.	21.	a.	b.	c.	d.
4.	a.	b.	c.	d.	22.	a.	b.	c.	d.
5.	a.	b.	c.	d.	23.	a.	b.	c.	d.
6.	a.	b.	c.	d.	24.	a.	b.	c.	d.
7.	a.	b.	c.	d.	25.	a.	b.	c.	d.
8.	a.	b.	c.	d.	26.	a.	b.	c.	d.
9.	a.	b.	c.	d.	27.	a.	b.	c.	d.
10.	a.	b.	c.	d.	28.	a.	b.	c.	d.
11.	a.	b.	c.	d.	29.	a.	b.	c.	d.
12.	a.	b.	c.	d.	30.	a.	b.	c.	d.
13.	a.	b.	c.	d.	31.	a.	b.	c.	d.
14.	a.	b.	c.	d.	32.	a.	b.	c.	d.
15.	a.	b.	c.	d.	33.	a.	b.	c.	d.
16.	a.	b.	c.	d.	34.	a.	b.	c.	d.
17.	a.	b.	c.	d.	35.	a.	b.	c.	d.
18.	a.	b.	c.	d.					

VITA

Edward William Liskovec was born in Thompsonville, Michigan, on June 29, 1929. He graduated from Galesburg High School in 1947. He joined the U.S. Navy on April 5, 1948, and retired on July 27, 1967. The following month he accepted a position as insurance consultant for Metropolitan Life Insurance Company. In January, 1971, he enrolled in Seminole Community College, graduating in August 1972 with an Associate Arts degree. The following month he entered Florida Technological University and in June, 1974, he received a Bachelor of Arts degree in Business Education. In August, 1974, he accepted the position of Vocational Office Education teacher at Seminole High School. In September, 1975, he accepted a graduate teaching assistantship and entered graduate school at The University of Tennessee. He received the Master of Science degree in Business Education in August, 1976. He is married to the former Martha Lauree Wright of New Smyrna Beach, Florida.