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**Wilson, Odell D., Ed.D.**

**East Tennessee State University, 1987**

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**300 N. Zeeb Rd.  
Ann Arbor, MI 48106**



AN AUTOMATED DIAGNOSTIC TEST AND TUTORIAL PACKAGE  
FOR BASIC SKILLS OF MATHEMATICS  
IN POST SECONDARY VOCATIONAL EDUCATION OF KENTUCKY:  
CONSTRUCTION AND VALIDATION

---

A Dissertation  
Presented to  
the Faculty of the Department of Supervision and Administration  
East Tennessee State University

---

In Partial Fulfillment  
of the Requirements for the Degree  
Doctor of Education

---

by  
Odell D. Wilson  
December, 1987

APPROVAL

This is to certify that the Advanced Graduate Committee of

ODELL D. WILSON

met on the

25<sup>th</sup> day of August, 1987

The committee read and examined his dissertation, supervised his defense of it in an oral examination, and decided to recommend that his study be submitted to the Graduate Council and the Associate Vice-President for Research and Dean of the Graduate School in partial fulfillment of the requirements for the degree Doctor of Education in Supervision and Administration.

*Danny H. Brown*  
Chairman, Advanced Graduate Committee

*Lynell M. Kerley*

*Eminent Bentley*

*Nancy Lewis Garland*

Signed on behalf of  
the Graduate Council

*Richard A. Crofto*  
Associate Vice-President for Research  
and Dean of the Graduate School

## ABSTRACT

# AN AUTOMATED DIAGNOSTIC TEST AND TUTORIAL PACKAGE FOR BASIC SKILLS OF MATHEMATICS IN POST SECONDARY VOCATIONAL EDUCATION OF KENTUCKY: CONSTRUCTION AND VALIDATION

by

Odell D. Wilson

The purpose of this research study was to determine characteristics of entering vocational students in Kentucky area state vocational schools and to develop a computerized diagnostic instrument and tutorial package for assisting students in the mastery of necessary basic skills in mathematics. After specific math skills were identified in which proficiency is required of vocational education students, item pools were constructed for each skill. The skill item pools were validated using approximately 500 public school students throughout the grades of four through eight in public schools of Harlan County, Kentucky; Lee County, Virginia; and Washington County, Tennessee. The items within each item pool were found to be statistically equivalent.

Computer programs were coded in the BASIC language using the item pools to randomly select and generate a diagnostic instrument and tutorial program relevant to the basic math skills. Three randomly generated forms of the diagnostic instrument were sent to 100 students in twenty area state vocational schools of Kentucky for normalization and form validation. The diagnostic instrument showed a strong positive coefficient of reliability with an average of .95 over the three forms used in the normalization process. There was no significant difference between the mean raw scores of the three forms. A 67 percentile score was found to be the norm which was to be statistically equivalent to the Tests of Adult Basic Education (TABE) at the 8.75 grade equivalent.

An experiment was conducted using vocational students at Hazard State Vocational School as subjects to determine the effects of the tutorial package on basic math skill mastery using equivalent forms of the diagnostic instrument for pretesting and posttesting. Results of the experiment indicated that the computer managed instruction tutorial package had a significant affect in increasing posttest scores of the experimental group over the control group.



It was concluded that the problem of constructing a computerized diagnostic math instrument and tutorial package capable of enhancing mastery of basic math skills to assist vocational students in gaining entrance into vocational school was achieved. A recommendation was made for further research and development to use the random item pool model for other development of computer assisted instruction (CAI) software.

Institutional Review Board

This is to certify that the following study has been filed and approved by the Institutional Review Board of East Tennessee State University.

Title of Grant or Project A Computerized Diagnostic Instrument  
for Assessment and Development of Basic Math Skills in  
Vocational Education

Principal Investigator Odell D. Wilson

Department Supervision and Administration

Date Submitted August 25, 1987

Principal Investigator Odell D. Wilson

Institutional Review Board Approval, Chairman Ernest A. Desjardet

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## Chapter 1

### Introduction

Computer Assisted Instruction has become a new medium for education in the 1980s. Educators through their tasks in supervision must be proficient with the uses of the electronic text. Materials must be provided for and the curriculum developed around this valuable resource of our rapidly developing technological society. Never before has so much power of manageability and individualized instruction been within the grasp of educators as it is today.

Direct influence into the teaching process of assisting students with developing skills in fundamental mathematics can be made via the computer. Mastery of fundamental skills in arithmetic and elementary mathematics continues to be a major factor in the success of the individual functioning in any vocational environment. Therefore, it is a major goal of the supervisor to design better means of identifying math skill deficiencies of vocational students and offer vehicles for proper remediation of these skills.

This study grew out of an awareness that, although mastery of fundamental math skills is necessary to successfully complete a postsecondary vocational education program of study in Kentucky, existing diagnostic instruments and remedial materials in the area of math were not sufficient in helping applicants and students master required math skills. Historically, vocational students in Kentucky

score low on entrance math aptitude tests as measured by the Test of Adult Basic Education (TABE). An accumulative score of 50 points is required to gain admittance into a Kentucky area vocational school vocational trade program. Adults often fail to pass the requirements of the test in mathematics and need access to an individualized diagnostic instrument and tutorial package that will assist them in mastering the skills as measured by the TABE instrument relevant toward their vocational career.

Since microcomputers are installed in all the area state vocational schools of Kentucky, it was decided, through an informal needs assessment through vocational teachers and counselors and vocational state directors at the Kentucky Department of Education, to design an automated computerized diagnostic test and computerized tutorial package for basic skills of mathematics for vocational applicants and students. In order that each individual might not render the instruments useless by learning items during the diagnostic and tutorial process, a random "item pool" technique was used in the design of the instruments. Software was developed to have the computer generate different versions of the diagnostic test and tutorial package each time an individual ran the computer programs. Also the option of having the computer generate a printed copy of a practice skills test was included to be used by counselors and teachers on an individualized basis.

The only feasible means by which an individual can write the instruments and obtain immediate personalized diagnosis of the results along with statistical comparisons of a relative norm group



is via a computer programmed for this purpose. Upon being given prescriptive instruction of mathematical skill weaknesses, the individual may then concentrate on skill deficiencies through practice on the computerized tutorial package with reference to a Student Skills Reference Manual describing fundamental mathematical operations.

### The Problem

#### Statement of the Problem

The problem of this study was to construct and validate a computerized diagnostic basic math skills inventory instrument relevant to entering area vocational education students of Kentucky and to design an accompanying computerized tutorial package capable of enhancing those skills, and to determine if the instruments will assist students in passing the TABE entrance exam, therefore gaining admission to vocational school.

#### Subproblems

1. The first subproblem was to determine specific basic math skills in which proficiency is required of area vocational education students of Kentucky.
2. The second subproblem was to build validated item pools of equivalent formatted math problems for each skill.
3. The third subproblem was to code computer programs for the diagnostic instrument and tutorial package with random pool selection capabilities compatible with the Tandy Radio Shack (TRS-80 Model III) computers, the Apple IIe computers and the IBM personal computers.

4. The fourth subproblem was to validate the "item pools" of the diagnostic instrument through field tests in Eastern Kentucky, Southwest Virginia and East Tennessee using elementary and junior high level public school students of grade levels four through eight.

5. The fifth subproblem was to select a stratified random sample from the population of vocational students and establish norms for the diagnostic instrument.

6. The sixth subproblem was to select a sample from the population and determine if a significant difference existed between pretest and posttest scores when using the tutorial package as the variable in the experimental group.

#### Purpose of the Study

It was the purpose of this research project to determine characteristics of entering vocational students in Kentucky area vocational schools and to develop a computerized diagnostic instrument and tutorial package for assisting students in the mastery of necessary basic skills in mathematics.

#### Significance of the Study

One of the most serious barriers to postsecondary vocational education students in Kentucky is the inadequate relevant mathematics skill mastery of area students. Since specific mathematical skills are required for functional proficiency and entrance into the vocational education programs, the individual entering a vocational career should be aware of his/her skill proficiencies and have a means to enhance those skills. A criterion referenced instrument

with multiple equivalent variations is needed in order to provide students individualized remediation for basic math skill mastery. Once the skill deficiencies are identified (diagnosed) then the person may correct those deficiencies by learning through various levels of the tutorial package and then re-evaluating his/her skills through an equivalent form of the diagnostic instrument. The process may be repeated until the student masters the skills and therefore is able to pass an entrance exam and be ready to build a successful vocational career.

### Hypotheses

The following hypotheses stated in the interrogative format and tested at the .05 level of significance using a two tailed-test were developed for this study.

H<sub>1</sub>: Will each item pool show reliability and internal consistency?

H<sub>2</sub>: Will each item pool have items that show no significant difference in item difficulty and item discriminating ability?

H<sub>3</sub>: Will the diagnostic instrument show reliability and internal consistency?

H<sub>4</sub>: Will the diagnostic instrument show validity?

H<sub>5</sub>: Will the norms of the diagnostic instrument be significantly different from the TABE norm for the sample group?

H<sub>6</sub>: Will there be a significant difference among the mean scores of the normalizing group in relation to various skill categories of the diagnostic instrument?

H<sub>7</sub>: Will there be a significant difference between the pretest and posttest scores of the control group and the experimental group after the tutorial package treatment has been applied?

#### Assumptions

1. It is assumed that each respondent participated seriously to the instrument in a manner as specified by the instructions of the instrument.

2. It was assumed that all statistical computer packages and the developed instruments were error free in their coding and processing.

3. It was assumed that the variations in time of administration of the instrument had no effects on the results.

4. It was assumed that each respondent was under similar testing conditions.

#### Limitations

1. The study was limited to randomly sampled persons enrolled in post secondary vocational education in area schools of Kentucky during the spring of 1987.

2. The study was limited to the identified mathematical skills similar to the Test of Adult Basic Education (TABE) - Level D and the California Achievement Test (CAT).

3. The designed computer software was limited to fit the Tandy Ratio Shack Model III computers (TRS-80), the Apple IIe computers and the IBM personal computers and compatibles.

### Definition of Terms

1. Coding--The process of writing instructions following specific computer language syntax (Horn, 1981).
2. Diagnostic Instrument--A test to identify specific categorical areas of strengths and weaknesses of basic mathematical skills (McArthur, 1985).
3. TABE--Tests of Adult Basic Education (Tiegs & Clark, 1976).
4. Validated pool--Mathematical test items that are similar in operational format and have been shown to be statistically equivalent in difficulty (Cunningham, 1979).

### Procedures

Examined were generic functional mathematical skills in whole numbers, fractions, decimals, ratios, percents, measurements and problem solving. State wide norms were established by administering a validated instrument criterion referenced to the specified math skills using a stratified random sampling procedure. A computerized diagnostic instrument for assessment and tutorial development of generic basic math skills in the categories of computation, understanding concepts and problem solving relevant to vocational education was then designed and standardized.

The assessment instruments (tests) were designed upon a validated item pool technique in which the computer selects random test questions from a "validated pool" of math items relevant to each skill. This procedure offers practically an unlimited number of pretest and posttest that are statistically equivalent. This design

prohibits the student from "learning the test" and better assesses progress. Also the design instrument can be used as a pretest and practice test for student preparation to the Test of Adult Basic Education (TABE), from which a passing score must be obtained by vocational education students in the state of Kentucky.

A computerized generic mathematics skills tutorial package was designed capable of branching to three levels of difficulty, ranging from introductory to mastery levels. The use of this computerized diskette package prepares the student through drill and practice to achieve mastery of the fundamental math skills. Since computer hardware varies among the various vocational schools in Kentucky, the computerized diagnostic package and the tutorial package were designed in three language formats to fit the Tandy Radio Shack (TRS-80 Model III) computers, the Apple IIe computers and the IBM personal computers and compatibles. All software was designed to be fully automated with little user "start-up" interaction required.

The skills addressed in both the diagnostic and tutorial instruments were:

1. Mathematics computation as addition, subtraction, multiplication and division of whole numbers, decimals and fractions.
2. Mathematical concepts as related to number theory, symbols and expressions with elementary algebra, geometry, metric measurement, sets, monetary place value and mensuration formulae.
3. Word problems in reference to one- and two-step operations, graphs, geometry, ratios, percentages, averages and rationalizing process in field definitions.

An experiment was conducted to determine if a significant difference existed between the pretest and posttest scores of the experimental group and the control group using the tutorial package as a variable. A short explanation of the steps followed in this study are listed below with expanded explanations in Chapter 3.

1. An informal needs assessment was conducted.
2. Determination of specific basic math skills was made through literature and computer searches.
3. Items pools were constructed.
4. Computer programs were designed and coded for the diagnostic and tutorial instruments.
5. Permission was obtained from the East Tennessee State University Institutional Review Board to use human subjects in the study.
6. The items pools were validated through data collected from administering math problems to elementary and high school students in grades four through eight in Eastern Kentucky, Southwest Virginia and East Tennessee.
7. The diagnostic instrument was normalized using randomly selected subjects from area state vocational education schools in Kentucky.
8. An experiment was conducted using randomly selected subjects at the Harlan and Hazard Area State Vocational Technical Schools in Kentucky using the tutorial package as a variable.
9. Statistical analysis was conducted and conclusions and recommendations were formulated.

### Organization of the Study

This study was organized into five chapters. Chapter 1 consisted of the introduction, the statement of the problem with supporting subproblems, the significance of the study, the limitations, the assumptions, the definitions of terms, the hypotheses and the organization of the study.

A review of related literature is contained in Chapter 2.

Chapter 3 contains the method of the study describing the subjects, instruments, research design, and the procedure of the study.

An analysis of results is written in Chapter 4.

Chapter 5 is a discussion of the study containing a summary, findings, conclusion, implications and recommendations for further research.



## Chapter 2

### Review of Related Literature

Curriculum development according to Harris is listed as the first task of supervision. According to Rubin and Lewey, developing the curriculum involves designing or redesigning the materials to be taught, by whom, when, where, and in what manner (Harris, 1985). Supervisors must be proficient in selecting, previewing, evaluating and designing materials for instructional use according to Harris. Planning for effective use of microcomputers in today's rapidly changing curriculum is of most importance. Scientific and technological advancements have progressed more in the last twenty years than in the previous twenty centuries (Hoyle, 1983). The only means to cope with and master our current "Information Age" is that of using computers (Naisbitt, 1982).

Educators must be fully aware of and master the new medium of educational transmission and allow the old transmission models to go if schools are to survive (Coon, 1982). Coon explains that the method of teacher as lecturer is most prevalent and very ineffective. The teacher should become a facilitator of learning by helping students learn via the computer. Individualized instruction allows for individual needs and differences and can best be addressed with the computer. Its use in this manner must become the norm for all students and not just for special services and handicapped

remediation according to Coon. The authors from the Minnesota Educational Computing Consortium (MECC) argue for a needs assessment. An analysis of the current curriculum should be made and a plan of achievement using the microcomputers as a tool should be constructed (Neill, 1983).

The microcomputer has been used effectively as an instructional aid during the 1980s. An experimental study conducted at the University of Minnesota using microcomputer instruction as the experimental variable, compared to traditional instruction for the control group of intermediate algebra students, resulted in interesting findings by Ganguli. The results indicated that the students in the experimental group scored significantly better on all five sets of achievement tests over the control group, and also that the experimental group showed a positive attitude toward mathematics whereas the control group did not (Ganguli, 1986). Furthermore, research addressing Computer Assisted Instruction (CAI) conducted by Kulik at the University of Michigan shows that in grades 6-12, achievement scores are higher for those students that receive computer assisted instruction over those that do not. Data was gathered for the study over a 20-year period in the 1960s and 1970s (Bracey, 1982).

There are also arguments against CAI or at least place it into proper perspective. Dr. Thomas P. Ruff, at Washington State University, maintains that there is a misconception, that CAI in itself will improve the student's language skills and particularly math skills. Even though computers do provide opportunities for

individualization and immediate feedback and evaluation, Ruff states that it is not clear that the applications programs are cost effective (Ruff, 1985). Also according to Reetz, if the same amount of time was spent with a regular workbook, results would be similar. The issue is addressed as to the logic of spending \$2000 for an electric workbook when a standard \$2.95 workbook with drill and practice would accomplish the same thing (Reetz, 1983). There was no formal research study conducted by Reetz, but rather his opinion was published in relation to why students are not learning actual computer programming.

Vendors through the mass media have attempted to program the public to believe that every student from preschool to college should have their own personal computer in order not to be disadvantaged. It is estimated that 11 percent of homes and 52 percent of all schools have microcomputers. Surveys reveal that most people believe it is the school's responsibility to provide computer literacy as well as the three R's (Spivey, 1985).

The most appropriate utilization of microcomputers in the early grades does not appear to have been firmly established. While educators are establishing the cost effectiveness of incorporating computers into the curriculum, they are finding that the hardware has already been purchased and the question of how to use it becomes the issue. Even though everyone seems fascinated by the novel purchase, their enthusiasms are dampened upon learning that they do not know how to use them or properly incorporate them into the curriculum (Spivey, 1985).

Spivey conducted an experiment on the effects of CAI using a pretest-posttest control group design. The study was to determine effectiveness of traditional classroom approach to instruction involving addition and subtraction for first graders. A computer game called Alligator Mix was used as the experimental variable. Even though both groups improved over their pretest scores, there was no significant difference between the posttest means of the experimental and control group using the t-test. This seems to point to the examination and selected use of software in the curriculum.

Another serious barrier to educators and the uses of computers with computer assisted instruction is that there is little compatibility between computer systems. Even though computer manufacturers may use the same microprocessor programmed with the same instruction set there are so many variables that interchangeable software is very limited. The computer language with specific instructions for user software usually will interchange from one manufacturer's system to another if the machines are designed to use that particular language. The real problems arise in the external storage and retrieval systems using special commands under specific Disk Operating Systems (DOS) instructions. Each manufacturer uses slightly different instructions for organizing the file allocation table, booting and directory instructions and the manner in which computer disks are geometrically organized into tracks and sectors.

The Micro Soft Disk Operating System instruction set (MS DOS) is essentially used by the IBM PC computers. Radio Shack uses a different system called TRS DOS. These two are not compatible even

though software instructions for specific application software may be the same. For example, a BASIC program may run on both the IBM PC and the TRS-80 microcomputers but the disks on which the programs are stored are not compatible.

There are some universal constants between computer manufacturers. One of these is the binary code by which characters are referred. One such universal code is the American Standard Code for Information Interchange (ASCII). This standard for data transmission assigns 7 bit codes to represent numerals, letters and special characters on a standard 128 keyboard (Exeter, 1983). Therefore, using the ASCII code, it is possible for noncompatible computer hardware to be linked through a communications bus and actually transmit records, files and programs from one Disk Operating System to another.

The Educational Testing Service (ETS) did a four-year study in the Los Angeles Unified School District and found that in grades 1-6 students that had access to computers for 10 minutes per day scored significantly higher in mathematics than students who had no exposure (Bracey, 1982). Therefore, there seem to be factors affecting achievement in math in relation to attitude. Findings in this study show that positive attitudes increase also as a result to exposure to the computer.

The uses of microcomputers in education, as CAI, can be divided into five user categories: drill and practice, tutorial programs, demonstrations, simulation, and instructional games (Coburn, 1982). For remediation purposes, drill and practices through tutorial

programs and analyzing diagnostic tests seems to be the most effective use of the microcomputer (Nobel, 1982). Educators need not be experts in computer programming in order to take advantage of the mass of educational software available today. However, Serabian (1983) recommends that school districts should organize inservice programs for staff members giving them experience with computers in order to effectively incorporate microcomputer use into the curriculum. Hands-on experience is necessary for a proper learning experience whether the curriculum purpose is for computer literacy or CAI and remediation (Grady, 1983). In Minnesota, the Minnesota Educational Computing Consortium (MECC) was created with a supervisory vision of organizing computer use from the elementary school through the university level and community college system (Rawitsch, 1982). Today MECC is the educational leader in educational computing.

#### Assessment of Math Skills

A summary from the National Assessment of Education Progress (NAEP) shows that student performance is declining in mathematics and science (Heron, 1985). In a comparison done by Husen (1983) of twelve industrialized countries of students taking mathematics, American high school graduates fall "far below" those of other countries. Even the top four percent of American graduates fell below eight of the other countries.

A partial solution as described by Heron (1985) is to discontinue the automatic payment of supplements to all vocational

teachers who happen to meet the criteria for extended contracts. These funds should be used instead by the local boards for the express purpose of supplementing teachers in critical areas where a shortage of qualified personnel exists like mathematics and science. For example, in 1980 there were over one thousand unfilled mathematics teachers' positions in the secondary schools of the United States with salary level approximating 75% of private industry. The dwindling trend started in the mid-1970s with fewer than 2% of the bachelors degrees conferred in mathematics education. The ratio of physical-education to mathematics education during this period was approximately 20:1. Higher pay will improve the attractiveness of careers in teaching mathematics (Heron, 1985).

Recently, a second study has been done similar to that by the International Association for the Evaluation of Educational Achievement (IEA) as that previously described by Husen. The second study preliminary findings show that the curriculum in America's secondary school does not properly prepare students for college calculus and that the methodology of teaching fundamental arithmetic skills in grade eight should be restructured. "More of the same, may not be the kind of reform of secondary mathematics that U. S. students need. The National Science Board Commission has stated that, as the effects of computers and other high technologies come to be felt in society, discrete mathematics should be regarded as fundamental for all students. The kind of mathematics to be offered to those students who will be taking more mathematics than ever before and how to teach it to them are among the major issues that

confront those who would reform mathematics education in the U. S. "(Travers, 1985).

The U. S. Coast Guard is using a CAI approach for solving skill deficiencies in math for its recruits. In the early 1980s the U. S. Coast Guard was facing discordance for problems between the need for a high aptitude entry level work force and the actual aptitude level of its recruits (Glidden, 1984). In order to solve its problems, a training program was developed involving the integration of the Control Data PLATO basic skills curricula computer-assisted instruction. The strategies employed in the program appear helpful showing an increase of 6.8 percent on the Armed Forces Vocational Aptitude Battery (ASVAB) over the mean scores the preceding year.

The concern for math competency has motivated educators to try to unravel the processes underlying the acquisition of various mathematical skills. Research shows that there are four sets of contributing factors: (1) subject variables or the characteristics of the learner; (2) task variables - i.e. the mathematics content problems themselves; (3) process variables - i.e. the cognitive mechanisms students use to solve mathematical problems; and (4) instructional or environmental factors. These were outlined in a publication by Lester in 1980. Early evaluation of the effectiveness of computer based educational programs show positive results. However, there are many factors that should be examined in CAI research. For example, computer assisted instruction may be better suited for the cognitive styles of some students while not



for others (Walker, 1985). Also teachers may need to reinforce the skills within the classroom that students are experiencing difficulty in mastery.

Insights for computer based instruction finds its roots in the structuralism of Piaget and Bruner. Skinner's operant conditioning follows the logic of programmed learning and computer assisted instruction (Grossnickle, 1983). Other attributes that highlight the significance for inclusion in the instructional environment reported by Rosenshine and Furst are: (1) frequent feedback to learners; (2) tutorial relationships; (3) individual pacing; (4) individual programming; (5) clarity of presentation; (6) motivational factors; (7) task oriented instruction for improving learning (Walker, 1985). These are facets that can be easily attained by the computers.

From a programatic point of view the computer can accomplish all this while releasing instructors to concentrate on higher level cognitive instruction. The most widely accepted modes of instructional strategies are drill and practice, and tutorial. However, CAI is most effective when used as a drill and practice instructional tool rather than as a tutor as shown by studies by Cranford and Romero showing positive effects on mathematics achievement for students using CAI drill and practice (Walker, 1985).

Computer Assisted Instruction Models have been developed for special vocational programs in the Hardin County School curriculum in Elizabethtown, Kentucky. A guide was developed intending to assist vocational educators provide CAI to students in basic skills. As well as the curriculum addressing the components and use of the

TRS-80 microcomputer and other verbal skills, several areas in mathematics basic skills were involved. The topics of computation of mathematical averages, fractions and problem solving skills were included (Daniels, 1985).

Even though educators seem to agree to the inevitability of the computer becoming an integral part of the curriculum, there also appears to be pros and cons of computer use in the schools. Educators do not agree on how the computer should be included in the curriculum or at what age level computer education should begin (Jaworski, 1984). At first the computer was mainly used at the secondary level restricted to mathematics. According to a computer educator, John Martin, the computer could remove the drudgery and inefficiency of the curriculum both at the elementary and secondary level and elevate the schools to a more respected sustaining function within our society (Jaworski, 1984). There are ideas that computer education is ineffective and inefficient, due to the lack of teacher training and quality software as the cause of the problem (Jaworski, 1984).

Levin, in 1984, conducted a study to look more closely at the issue of costs and cost-effectiveness of the use of microcomputers for CAI. Levin explored four assumptions: (1) that computer hardware accounts for most of the cost of delivering CAI; (2) that drastic declines in future costs of computers will create similar reductions in CAI; (3) that networks of microcomputers used for CAI are less costly than minicomputers with similar capabilities; and

(4) that CAI has been found to be more cost effective than other instructional alternatives (Levin, 1984). Levin found that the first three assumptions were directly contradicted by the available evidence when compared to reducing class size, lengthening the school day and adult tutoring, but less cost-effective than peer tutoring.

Another study was conducted by Main in 1984 to see if CAI could be used successfully with the low level non-reading adult such as the mentally handicapped and other educationally handicapped adults in an adult basic education (ABE) program. All students made significant progress in word recognition and showed a gain in math progress. All work was done on the TRS-80 Model III computers. Conclusions were that CAI seems highly feasible for adult non-readers and handicapped adults with students performing best with short frequent periods of instruction on the computer.

#### Mathematics Materials Construction

Computers indeed can enhance learning of mathematics, but if the software developed for CAI cannot be used as a result of insufficient quantities of hardware, then the problems remain. According to a 1986 survey by Quality Education Data, a Denver-based information company, 91.3% of all schools at the opening of the 1985-86 school year were using microcomputers for instruction. However, except in the most economically affluent schools, as many as 250 students may share one microcomputer (Mandell, 1986). A review of products of educational software companies show a plentiful supply of software in mathematics remediation as well as other academic areas. Most often

these materials have not gone through a research and development process, but have been simply programmed, leaving their validity in question. Recently, however, producers are at least taking the time to field test their products before placing them on the market. Educators should purchase educational software only on a trial examination basis (Troutner, 1985). "Computers are powerful educational tools that can bridge the student/teacher gap" (Voluk, 1985). Students and parent volunteers assist in the educational process by helping third graders that are arriving to school 20 to 30 minutes early to learn basic computation in mathematics.

The literature and research on computer assisted instruction (CAI) has expanded since the incorporation into the classroom in the early eighties. Henderson in his research, *Theory-Based Interactive Mathematics Instruction: Development and Validation of Computer-Video Modules* explored some approaches responsive to the needs of minority groups. The effort focused on the design of effective instructional software in mathematics with features directed toward women and minority students. Henderson's design focused on these students experiencing difficulty in learning mathematics. He developed modules on the concepts of factors, prime numbers, and fractions. His results of field trials showed that the modules were effective in teaching/reteaching skills to secondary students who had not made normal progress. He used an experimental-control group design and found that the experimental group exposed to CAI performed significantly better on an evaluation than did the control group.

There is a growing concern through the nation for the quality and status of mathematics and science education (Henderson, 1983). Mathematics scores have dropped steadily on college entrance exams since the early 1960s (Henderson, 1983). There is a clear need to reverse this trend and to accomplish ways in which underachieving students can participate more fully in scientific and technical careers. Adding to this problem are shortages of science and math teachers as well as general declines in appropriations for education.

Computer Assisted Instruction (CAI) significantly improved the math skills of elementary school children in an experiment conducted by McConnell in a Pasco, Washington School District. In this experiment involving 500 students in grades 3-6 over a two semester period, the students received one of three treatments: CAI, paper and pencil drill and practice, or the regular district math curriculum. The findings were that all treatments brought scores from below to above the norms in total math; however, CAI improved the learning of total math and computational skills significantly more than the other two. Also, a positive correlation existed between the length of time spent on the computer and gain in math performance (McConnell, 1983).

There are two agreed upon basic uses of Computer Assisted Instruction: those uses for supplements to regular classroom materials and activities, and as substitutes for other modes of instruction. The most common application has been for drill and practice programs. In this method the computer presents a math problem to the student and awaits a response from the student. The

computer responds accordingly with feedback, review, reinforcement and then follows with another problem (Henderson, 1983).

Areas of proficiency for vocational mathematics overlaps those basic skills in elementary and secondary school. The four basic operations of arithmetic--addition, subtraction, multiplication, and division in relation to whole numbers, decimals, and fractions--are required computational skills for mastery in the Kentucky public school system (McDonald, 1984). Also according to the text, Applied Math for Technicians, by Claude S. Moore, signed number skills, system of measurement both metric and English, one variable algebra, percents, ratio and proportion and mensuration formula are required skills for the vocational technical student. This is in agreement with the math skills measured by the TABE used in Kentucky area state vocational technical schools. The format of the math problems in Moore's text is based on application type situations.

The construction of math items is somewhat difficult especially in relation to "word problems". Marilyn Burns (1986) points out the need to take the trouble out of teaching "those pesky word problems" through real life strategies. She points out the need to develop relevant situations and the construction style of objective multiple choice answers in designing word problems. Item format has an affect on score in standardized achievement tests. White (1982) investigated the effect on children's test scores of different item formats used in standardized mathematics achievement tests. Identical content of mathematics computation was put into eight

different formats and administered to second graders. Differences in test scores between types of formats were statistically significantly different at  $p < .001$  ( $F = 45.25$ ) implying that what a student appears to have mastered in mathematics computation is greatly influenced by item format. The conclusion of the study was that greater attention should be given to item format in constructing standardized achievement tests (White, 1982).

In order to have a starting point for developing tests of mathematics achievement that can be tailored to the local district curriculum, Sandra Cunningham and others did a study in 1979. A criterion-referenced mathematics objectives and item bank for grades one through eight was developed. The mathematics objective-item bank contains 100 objectives each represented by five to eight multiple choice items, and their item discriminating indices in relation to the skills of decimals, fractions, geometry, graphs, numeration, problem solving and whole number operations. The items were field tested in 32 school districts (Cunningham, 1979). In the spring of 1980, Herbert administered a series of mathematics achievement tests to 31 fifth grade classes for the purpose of developing curriculum materials for grades kindergarten through 6. An experiment was conducted using a computerized Comprehensive School Mathematics Program (CSMP) as compared to more traditional programs. The findings were in relation to the Comprehensive Tests of Basic Skills, Form S, Level 2 and give another response for standardized math tests constructed from item pools.

According to studies conducted by McArthur (1985), the computer properly programmed can become an unparalleled asset in the context of diagnostic testing. McArthur explains that the task of computerized diagnosis is very demanding on computer software. Both logical and mathematical operations and computer user interactions must work effectively with the computer saving responses in long term memory for ending analysis. The programmer must take care in the development of diagnostic software to encounter exceptional input data from the user. Also the algorithm that is used to select the next item in sequence is critical, along with item calibrations (McArthur, 1985).

A review of various tests from the Buros Mental Measurement Yearbook show reliabilities ranging in values from .57 for computation, age 11, to .96 for general interaction for the 14- to 15-year-olds. Internal consistency reliabilities and standard errors are given in a review by Davison (1984) of the Test of Mathematical Abilities (TOMA). Minimal Articulation Competence, 1981 (T-MAC) shows a test-retest reliability coefficient of .94. The Basic Skill Inventory (BSI, 1982) reviewed by Gary J. Robertson reported reliabilities using the KR-20 and split-half coefficients ranging from .78 to .90 in mathematics. Robertson (1984) also summarized by stating that the idea of providing a bank of calibrated achievement test items from which subsets can be drawn to match local curricular emphasis is not new. One example of a publisher that offers such a program is the CTB/McGraw-Hill Objective Referenced Bank of Items and Tests.



Robert E. Boston, in his book, How to Write and Use Performance Objectives to Individualize Instruction, points out the need for task analysis. He emphasizes that in the development of materials, the students' needs and background must be taken into account and develop the materials in such a way as to meet student needs (Boston, 1972). Also, once the test or evaluation instrument has been developed, norms should be published stating the populations upon which the psychometric properties of the instrument were determined. Content and criterion related validities should be reported upon as well as reliability coefficients and internal consistency.

As summarized by a study by Robert Ronau (1985) at Kent State University, the identification and correction of student mathematics errors are a major component of responsible mathematics instruction. The microcomputer's diagnosis is thorough, consistent, and less time consuming than a mathematics diagnostician. Diagnostic testing and tutorial software through the microcomputer seems the only logical alternative in assisting applicants into the vocational technical schools of Kentucky to master skills in basic mathematics. The microcomputer offers an efficient individualized means of self help and with the proper instructions will serve education as an invaluable tool.

## Chapter 3

### Methods and Procedures

This chapter contains a description of the study, the research design, the population and selection of the sample, the procedures used to collect the data, development of the instruments, the treatment of the subjects, the procedures used for analysis of the data, and statement of the hypotheses in null form.

#### Description of the Study

The objectives of the study were to develop an instrument to diagnose specific math skill deficiencies of entering area vocational education technical students in Kentucky and build a computerized tutorial package to enhance mastery of those skills. The mathematical skill areas addressed were basic skills in computation, concepts, and problem solving. The computerized instruments were designed to be individualized with interactive simplicity being a major priority of the design.

In order to make the diagnostic and tutorial packages as versatile as possible with repeated exposure to an individual without having the same practice problems generated each time the computer program was run, an "item pool" method was incorporated. Each time an individual runs the computer programs, multiple choice math practice problems are randomly selected from validated item pools to generate practice test problems and practice problems for the tutorial package.

After reviewing the literature, specific formatted multiple choice math items were developed to match the skills required for mastery in Kentucky Secondary Schools and those required for entrance into the area vocational technical schools as measured by the Test of Adult Basic Education (TABE) evaluation instrument.

The item pools were validated using teachers and students in grades four through eight in Harlan County, Kentucky, Lee County, Virginia, and Washington County, Tennessee. The diagnostic instrument was normalized using an n of 100 by randomly selecting five students from the twenty area technical schools in the state of Kentucky.

An experiment was performed using the diagnostic instrument for pretesting and posttesting with the tutorial package used as the variable. Random selection for the experimental and control groups was conducted at two convenient sites at the Harlan State Vocational Technical School in Harlan, Kentucky, and the Hazard State Vocational Technical School in Hazard, Kentucky. The guidance counselors at each site were asked to administer the instruments in a specified standardized manner to the selected subjects and return the results to the researcher for statistical analysis.

A description of the steps followed in the study were as follows:

1. An informal needs assessment was made through conversations with area state vocational school teachers, counselors, and officers in the State Department of Vocational Education Unit of Research and Development.

2. A determination of specific basic math skills in which proficiency is required of area vocational education students of Kentucky was made through a review of related literature and an ERIC computer search conducted through a terminal at the State Department of Education in Frankfort, Kentucky.

3. Item pools were constructed with five items in each specific formatted pool for a total of 785 items in the diagnostic and tutorial package pools relevant to computation, concepts and problem solving.

4. Computer programs were designed and coded for the diagnostic instrument and the tutorial package with random item pool selection capabilities compatible with the Tandy Radio Shack (TRS-80 Model III) computers, the Apple IIe computers and the IBM personal computers and compatibles.

5. The pools were divided into 50 item printouts for the purpose of validation. Content validity was assured through professional evaluation of various math teachers in the grade levels four through eight in Harlan County of Eastern Kentucky, Lee County of Southwest Virginia, and Washington County of East Tennessee.

6. Permission was obtained from the East Tennessee State University Institutional Review Board to use elementary and secondary students as human subjects upon the permission of the classroom teachers as incorporating the item pool validation into planned class work. Permission was also obtained to use human subjects over 18 years of age as area vocational education students in the state of

Kentucky. An informed consent form was to be included with each request for participation.

7. The 50-item printouts were duplicated in numbers of 60 giving an  $n=60$  for each item in establishing statistical validity, item discriminating power and reliability for each pool.

8. Consultations were made with teachers in Harlan County, Kentucky, Lee County, Virginia, and Washington County, Tennessee, to determine grade levels for each pool packet in which the skills had been taught during the 1986-87 school year. This procedure gave a means in which to distinguish between items of varying difficulty.

9. The 50-item pool packets were collected and item analysis was made using the East Tennessee State University IBM computer and the software package called LERTAP.

10. After refinement three (3) forms of the diagnostic instrument were generated by the computer for the purpose of establishing norms for Kentucky area vocational students. A packet containing 5 copies of a diagnostic instrument, informed consent forms, answers sheets, instructions and return postage was mailed to twenty area and state vocational schools in Kentucky. A phone call was made to each counselor on the day of the mailing as a courtesy call verbally explaining the research project.

11. A random selection of five applicants and enrollees were made from a random alphabetical list generated by the computer from each vocational center. The counselors were asked to administer the instruments to the selected students and return the collected data.

12. Statistical analysis was performed using IBM software called StatPAK to determine norms for the instrument for Kentucky area vocational school students.

13. Two convenient area vocational school sites at the Harlan State Vocational Technical School and the Hazard State Vocational Technical School were selected for the experiment.

14. Sixty students were randomly assigned to the control group and the experimental group and given a pretest using a printed form of the diagnostic instrument containing 94 items. For the next five days the experimental group practiced using the tutorial package and a Student Reference Manual of Basic Mathematics Skills for a period of two hours per day. No variable was applied to the control group but rather left to the normal setting help measures available in the vocational schools.

15. All data was entered into the ETSU main frame computer for analysis via an optical scanner. From these results conclusions were drawn and recommendations were made for further research.

#### Research Design

The basic design of the study was research and development of the instruments with item pools, normalization of the population and experimental group using the tutorial package and Student Reference Manual as the variable. A validation study was performed on the item pools using approximately 500 public school students in grades four through eight in Harlan County, Kentucky, Lee County, Virginia, and Washington County, Tennessee. The teachers of these grades were

asked for evaluation of the items in order to establish content validity. Those items deemed of awkward format or unclear were improved or discarded. Item analysis was then done on the data collected using the LERTRAP package at East Tennessee State University. The index of difficulty was calculated along with the point biserial correlation and Hoyt estimate of reliability of each pool packet. Items were discarded or improved upon analysis.

Three 94 item forms of the diagnostic package were generated and sent to 100 randomly selected subjects in Kentucky area state vocational technical schools. Measures of central tendency and variability were applied in normalizing the instrument.

For the experiment, the pretest-posttest control group design was used (R O X1 O, R O X2 O) with random sampling, pretesting of the experimental and control groups, application of the treatment using the tutorial package and Student Reference Manual as the treatment and finally the posttesting.

The reliability coefficient for the diagnostic instrument was calculated using the split-half, odd-even method and the Spearman-Brown Prophecy Formula.

$$rt = (2 * roe) / (1 + roe)$$

rt = reliability of entire test

roe = coefficient of correlation of two halves

$$roe = (\sum XY / N - M_x M_y) / (SD_x SD_y)$$

The standard error of measurement was calculated by the formula:

$$SE = SD * \sqrt{1-rt}$$

SD = standard deviation of the distribution

rt = reliability coefficient of the test

A correlation coefficient for criterion-related validity was calculated using the Pearson r applied to the TABE skill norms and the instrument scores. The formula used was as follows:

$$r = (\sum XY/N - M_x M_y) / (SD_x SD_y)$$

The t-test, the Analysis of Variance, and the Analysis of Covariance were used to answer the research hypotheses relating to the means of the various skill levels between the means of the various forms and between the pretest and posttest scores of the experimental and control groups. Statistical analysis was performed via the SPSSX IBM STAT-PAK compatible with the IBM-PC.

#### The Population and Sample

Approximately 500 public school students in grade levels four through eight in Harlan County, Kentucky, Lee County, Virginia, and Washington County, Tennessee, were used in the item pool validation process. Permission was obtained from the East Tennessee State University Institutional Review Board to use these subjects with the teacher's permission. The teachers were used as professional evaluators to assist in establishing content validity for the item pools.



One hundred (100) subjects were randomly selected from the population of new enrollees of adult vocational education students in Kentucky area state vocational technical schools for the purpose of validating and normalizing three (3) randomly computer generated 94-item diagnostic instruments. The guidance counselors at each vocational center administered the instrument in a specified standardized manner to the selected subjects. Two convenient vocational site locations were selected to conduct the experiment at the Harlan and Hazard State Vocational Technical Schools in Kentucky. An n of 60 was randomly selected and divided into the experimental and control groups from the new enrollees of adult vocational education students.

#### Data Collection

All the data was collected on optical scanner forms (SCAN-TRON Form No. 3200) for the validation of the item pools which were answered by the public school students grades four through eight. Optical scanner forms were also used as answer sheets in the validation and normalizing process as well as the experiment. Informed consent forms were attached to the SCAN-TRON forms describing the study as specified by the Institutional Review Board.

#### Development of the Instruments

The instruments were designed in two separate phases. The computer softward and algorithmic process was designed to randomly select and generate tests and practice exercises selecting from a file data bank of item pools. All the computer instructions were

written in BASIC with the item pool files initially saved in ASCII format.

The specific math problems were designed in difficulty and format to model those basic math skills required for mastery in Kentucky secondary schools and those required for entrance into the Kentucky area state vocational technical schools as measured by the TABE. The basic computational math skills addressed were addition, subtraction, multiplication and division of whole numbers, decimals, and fractions. The concepts addressed were number systems and and symbols, geometry and mensuration formulae, money and place value with unit measurements and sets. Word problems were generated to include two-step operations, graphs, mensuration formula in elementary geometry, percentages, ratios and averaging. In order to fit the number of items onto one computer diskette for the diagnostic instrument, 240 items were generated for computation, 155 items in concepts and 75 word problem items. For the tutorial package, items were generated in the same areas of computation, concepts and word problems and also ranging in difficulty as easy, medium and hard problems in these areas. One hundred five items (105) were designed and formatted for each skill category for a total of 315 tutor practice items. The tutorial package was designed to automatically regress to a less difficult level if a user misses two consecutive problems on the same skill. Upon missing two easy problems the computer instructs the user to refer to the appropriate section in the Math Skill Student Reference Manual for further explanation.

Three diagnostic forms of 94 items each were generated by random selection from the item pools and used in the normalizing validation process and as pretests and posttests for the experiment.

#### Treatment of the Subjects

The teachers of the grade levels four through eight of the approximately 500 public school students administered the 50-item pool packets to their students as a work exercise to their classes. The students made their responses on the optical scanner forms using a pencil to mark one of five multiple choice answers as A, B, C, D, or E. The guidance counselors at the area state vocational technical schools selected five adult subjects from the random computer alphabetical list and administered the 94-item diagnostic instrument with the subjects again answering the multiple choice items on optical scanner forms. Thirty subjects were randomly selected and assigned in either the control or experimental groups both at the Hazard and Harlan State Vocational Technical Schools. Pretests were administered to both the experimental and control groups using a form of the computer generated, 94-item diagnostic instrument. For the next five days, the experimental group had access to the computerized tutorial floppy diskettes and the Student Reference Manual for a period of one hour per day on an individualized basis. Subjects in the control group were left in the normal environment to use remediation materials and sources as are available at the vocational center in reference to the TABE skills and format. A

posttest was administered using a form of the computer generated, 94-item diagnostic instrument to the control and experimental groups.

#### Procedures Used for Analysis of the Data

Hypotheses  $H_1$  and  $H_2$  were answered using the East Tennessee State University computer center and the software LERTAP was used in the item analysis of the item pools in determining coefficients of correlation, weights, item discriminating ability and the Hoyt estimate of reliability.

Hypotheses  $H_3$  and  $H_4$  were answered using the split-half, odd even method and the Spearman-Brown Prophecy Formula. A correlation coefficient for criterion-related validity was calculated using the Pearson's "r" two-tailed tests between the appropriate skill levels of the diagnostic instrument and the TABE.

Analysis of Variance and Analysis of Covariance were used to address hypotheses  $H_5$  and  $H_6$  in determining if means were significantly different and in determining if significant difference exist within the skill levels of the diagnostic instrument.

Analysis of Covariance was applied to the data collected from the pretests and posttests in answering hypothesis  $H_7$ .

#### Hypotheses

The following hypotheses stated in the null form tested at the .05 level of significance using two tailed parametric tests were addressed in this study.

$H_{01}$ : There will be no positive coefficients of the Hoyt estimate of reliability in each item pool.

$H_{0_2}$ : There will be no significant difference in item difficulty and item discriminating ability within each skill pool.

$H_{0_3}$ : There will be no positive coefficient in the reliability and internal consistency of the diagnostic instrument using split-half and the Sperman-Brown Prophecy Formulae.

$H_{0_4}$ : There will be no significant difference between norm skill level scores of the diagnostic instrument and the TABE in determining instrument validity.

$H_{0_5}$ : There will be no significant difference between the sample group's diagnostic instrument mean and the statewide Kentucky mean score of the TABE in mathematics.

$H_{0_6}$ : There will be no significant difference among the means of the various skill categories of the diagnostic instrument.

$H_{0_7}$ : There will be no significant difference between the pretest and posttest scores of the control group and the experimental group after the tutorial package treatment has been applied.

## Chapter 4

### Analysis of Data

The problem of this study was to construct and validate a computerized diagnostic basic math skills inventory instrument relevant to entering area vocational educational students of Kentucky and to design an accompanying computerized tutorial package capable of enhancing those skills, and to determine if the instruments will assist students in passing the Test of Adult Basic Education (TABE) entrance exam, therefore gaining admission to vocational school.

The subjects used for this study were from two distinct populations. Three hundred twenty public school students in the grade levels four through eight in Harlan County of Eastern Kentucky, Lee County of Southwest Virginia and Washington County of East Tennessee responded to the item pool validation process. Subjects for the normalization of the diagnostic instrument and experiment were selected from Kentucky area state vocational technical schools.

Seven null hypotheses were tested in the study. Statistical hypotheses were tested at the .05 level of significant difference using a two-tailed test.

$H_1$ : There will be no positive coefficients of the Hoyt estimate of reliability in each item pool.

The instruments were designed around a "validated pool" concept of math problems relating to specific basic math skills in math computation, concepts and problem solving. Approximately 400 public

school students in grade levels four through eight were requested to participate in the pool validation process. The Packets were compiled at eight different levels consisting of approximately 50 items each and administered to the students. The summary of the results follow in Table 1.

Table 1  
Item Pool Validation Data

Level #	No. of Observations	Mean	S. D.	Hoyt Estimate of Reliability
1	45	17.13	5.32	.83
2	43	20.67	7.95	.88
3	33	26.55	10.53	.92
4	38	19.95	6.43	.87
5	30	36.8	9.59	.94
6	36	27.89	12.03	.94
7	51	31.86	12.03	.95
8	44	32.14	9.32	.91

The Hoyt coefficient of reliability shows strong positive coefficients at all pool levels. Each level of pool items were validated using the basic skill requirements for grades four through eight (McDonald, 1984). Criterion referenced validity was established through professional review of the items before each grade teacher administered the pool packets. This analysis indicated that the item pools had both content and criterion referenced validity with high positive coefficients of reliability. The null hypothesis was

rejected and the alternative hypothesis that each item pool has a positive coefficient of reliability was accepted.

$H_2$ : There will be no significant difference in item difficulty and item discriminating ability within each skill pool.

In addressing hypothesis  $H_2$ , individual item review was conducted using professional teachers as criterion and format critics. Once the items had been examined and improved where suggested, they were combined in skill categories and administered for validation purposes. Table 2 shows the twenty-five skills addressed in the eight levels of validation packets and the relevant statistical data.

The mean item difficulty index was computed for each item within each skill pool. Analysis of Variance showed that there was no significant difference between the level of difficulty and the point biserial correlation with the total test level.

Failure to reject the null hypothesis was established. There was no significant difference in item difficulty and item discriminating ability within each skill pool.

$H_3$ : There will be no positive coefficient in the reliability and internal consistency of the diagnostic instrument using split-half and the Spearman-Brown Prophecy Formulae.

Three randomly generated ninety-four item diagnostic instrument forms, labeled as Form 1, Form 2 and Form 3, were sent to Kentucky area state vocational schools for the purpose of establishing reliability factors and norms for the instrument. Five enrolled students were randomly selected from each school site and the



Table 2

Item Analysis for Skill Pools

Skill Pool	Item Difficulty (P)	Level	Item Discrimination (PB-TT)
Addition of Whole Numbers	.93	1	.26
Addition of Decimal Numbers	.34	1	.43
Measurement Addition	.21	1	.08
Addition of Fractions	.16	1	-.05
Subtraction of Whole Numbers	.82	2	.38
Subtraction of Decimals	.54	2	.46
Measurement Subtraction	.15	2	.18
Subtraction of Fractions	.14	2	.21
Multiplication of Whole Numbers	.54	3	.35
Multiplication of Decimals	.63	3	.36
Measurement Multiplication	.29	4	.13
Multiplication of Fractions	.68	4	.39
Division of Whole Numbers	.73	4	.37
Division of Decimals	.55	5	.42
Division of Fractions	.62	5	.36
Numeration Systems	.84	5	.32

Table 2 (continued)

Item Analysis for Skill Pools

Skill Pool	Item Difficulty (P)	Level	Item Discrimination (PB-TT)
Symbolic Expressions	.84	6	.65
Geometrical Measurement	.57	6	.56
Monetary Place Value	.41	6	.33
Word Problems	.63	7	.39
Graphing	.38	7	.58
Geometry Problems	.48	7	.37
Percentage	.93	8	.77
Ratio	.41	8	.57
Averaging	.86	8	.45

\*P pool average

PB-TT point biserial correlation - total test

instrument was administered by the Guidance Counselors of each school. Table 3 contains the relevant normalization and validation statistics for each form.

Table 3

Normalization Data for the Diagnostic Instrument

Form Number	<u>n</u>	Coefficient of Reliability	Standard Error of Measurement
1	20	.94	3.8
2	14	.97	3.63
3	29	.93	3.69

The reliability coefficients of diagnostic instrument were strong positive and the null hypothesis was rejected.

$H_4$ : There will be no significant difference between norm skill level scores of the diagnostic instrument and the TABE in determining instrument validity.

Table 4 shows the mean score of each diagnostic instrument form along with other data used in the Analysis of Variance computation.

Table 4

Diagnostic Instrument Data for ANOVA

Form Number	Mean	Variance
1	63.5	242
2	62.1	411
3	62.2	191

Table 5 shows relevant data using ANOVA to determine if each form was statistically equivalent.

Table 5  
ANOVA for Alternate Forms of the Diagnostic Instrument

F value	dfN	dfD	Totals 5	Mean Variance	Variance of Means	P Value
.04	2	60	15338	281.77	.57	.96

The means of the three randomly generated forms of the diagnostic instrument are not significantly different. Therefore, the researcher failed to reject the null hypothesis.

Further comparison of the diagnostic instrument skill categories to the equivalent categories in the TABE are shown in Table 6.

Table 6  
Comparison of Skill Levels of TABE to Diagnostic Instrument

TABE:	RS	Scale Score	SD	KR20	RSP	n
Grade 6	35	402.4	69.3	.93	.36	580
Grade 7	44	443.0	74.4	.94	.45	765
Grade 8	55	485.6	96.0	.97	.56	731
Diagnostic Instrument:	RS	SD	Hoyt	RSP	n	
Grade 6	30	12.03	.93	.31	51	
Grade 7	45	9.59	.94	.46	43	
Grade 8	56	6.43	.87	.57	38	

RS = Raw Score  
RSP = Raw Score Percentage  
SD = Standard Deviation

Using the two-tailed z test to compare a sample mean to a population mean entering known means and standard deviations from Table 6 shows that the p values are not sufficient to reject the null hypothesis as noted in Table 7.

Table 7  
p Values of Grade Equivalency Skill Categories

Grade	p Value
6	.68
7	.92
8	.88

In relation to the grade equivalent skill categories of the diagnostic instrument as compared to the TABE grades six through eight, the researcher rejected the null hypothesis and accepted the alternative hypothesis.

H<sub>5</sub>: There will be no significant difference between the sample group's diagnostic instrument mean and the statewide Kentucky mean score of the TABE in mathematics.

Table 8  
Diagnostic Sample Means Compared to Kentucky TABE Means

Form	Mean	SD	G.E.
1	63.5	15.56	8.85
2	62.1	20.29	8.7
3	62.2	13.82	8.7
TABE	62.5	11.86	8.75

Table 8 displays the data necessary to perform the computation. In comparing the diagnostic forms to the TABE a p-value of  $p = .995$  was obtained using a two-tailed z test for comparison. The researcher failed to reject the null hypothesis.

$H_6$ : There will be no significant difference among the means of the various skill categories of the diagnostic instrument.

The means of the various skill levels having different computational and conceptual skills was taken from Table 1 and Analysis of Variance was used to determine if significant differences existed. A p value of  $p = .02$  was obtained thus implying that the samples were significantly different. The researcher rejected the null hypothesis and accepted the research hypothesis that there are significant differences among the mean scores of the various skill categories of the diagnostic instrument.

$H_7$ : There will be no significant difference between the pretest and the posttest scores of the control group and the experimental group after the tutorial package treatment has been applied.

Table 9 shows a compiled listing of the collected data obtained from the experiment.

Table 9

Experimental Data - Computer Assisted Instruction

Group	Mean	MED	SDEV
Experimental Pretest	48.79	49.5	6.23
Control Pretest	50.93	54	14.04
Experimental Posttest	60.93	64	14.96
Control Posttest	49.07	53	18.28

The t-test was used to compute the significance of any differences between the groups. Table 10 displays the t values and p values of the various group comparisons as well as a column for being significantly different.

Table 10

T-tests of Experimental and Control Groups

Groups Compared	T Value	p Value	Significantly Different
Experimental Pretest-Control Pretest	.522	.606	No
Experimental Pretest-Control Posttest	.05	.956	No
Experimental Pretest-Experimental Posttest	4.19	.001	Yes
Control Pretest-Control Posttest	.836	.418	No

As shown there was no significant difference between the experimental pretest and the control pretest scores. Also there was no significant difference between the experimental pretest and the control posttest scores. There was a significant difference between the experimental pretest and experimental posttest scores using the computerized tutorial package as the variable.

There was no significant difference between the mean scores of the control pretest and the control posttest. Based upon the p value of  $p = .001$  of the experimental pretest-experimental posttest comparisons the researcher rejected the null hypothesis and accepted the research hypothesis that significant differences existed between

the pretests and posttests scores of the control group and the experimental group after the tutorial package treatment had been applied.



## Chapter 5

### Summary, Conclusions and Recommendations

This was a research and development study with the purpose of determining math skill characteristics of entering vocational students in Kentucky area state vocational schools and developing a computerized diagnostic instrument and tutorial package for assisting students in the mastery of necessary basic skills in mathematics. After specific skills were identified, item pools were constructed and modeled after the item format requiring mastery before entrance into a Kentucky vocational school.

In order to offer the student a set of different, statistically equivalent problems for diagnostic review and tutorial practice each time the student required self evaluation, a computer was used to store the item pools. A computer program was then designed and coded to instruct the computer to randomly select and generate a 94-item diagnostic instrument addressing the skills. The program was designed to allow an individual to take the diagnostic evaluation via direct interaction with the computer or have the computer print out a unique printed copy followed by answers to be administered by a teacher or counselor.

Public school students in grades four through eight were used in determining the statistical equivalence, validity and reliability of the item pools. The items within each skill pool showed no

significant difference in item difficulty and all pools showed a strong positive correlation for test reliability.

Three printed forms of the diagnostic instrument were generated by the computer and sent to all twenty area state vocational schools in Kentucky where five students were randomly selected for the normalization of the instrument for recently enrolled vocational students. All three forms were found to have very high coefficients of reliability, all three were statistically equivalent and the norms were equivalent to the Test of Adult Basic Education (TABE).

In order to address the problem of determining if the instruments would assist students in enhancing mastery of basic math skills, an experiment was conducted using area state vocational technical schools as the subjects. The randomly generated forms of the diagnostic instrument were used as pretests and posttests with the computerized TRS-80 version tutorial package used as the variable. The tutorial package was a computer program coded in BASIC for the TRS-80 Model III microcomputer using item pool selection from three levels of difficulty pools labeled as easy, moderate, and difficult. Twenty-one skills were addressed by the tutorial with references made to the Student Skills Reference Manual. The experimental group showed significant gains after being exposed to the tutorial package for a time of five hours over a period of five days.

As part of this study, a trial experiment was conducted to transfer programs and files stored on disks generated and stored by Radio Shack's TRS DOS TRS-80 microcomputer to an IBM PC using a

version of MS DOS. Technical consultants from the Tandy Company Radio Shack area division in Johnson City, Tennessee, were consulted in this problem. Their recommendations were that the transfer could take place through the RS 232 input/output ports (I/O ports) of the computers if a serial cable and a null modem were used in line series to connect the two systems. Also communication software must be obtained for each computer system enabling the two machines to communicate with each.

The consultants recommended Videotex Plux as the communications package for the TRS-80 model III computer. For the IBM a communications package called PC-Dial was selected. Simply connecting the computers together is not sufficient for communication. Many parameters must be controlled and perfectly timed for data to be transferred. This "handshaking" can only occur if factors such as the baud rate, bit length, parity and other parameters are synchronized through communication software.

In order to gain a deeper understanding of the process and structural hookups involved, professors at the East Tennessee State University Computer Science Department were consulted. A system was linked between the IBM PC and a Texas Instrument PC for the purpose of transferring word processing text. The system appeared to work well for that application, thus a similar model design could be constructed between the TRS-80 model III and the IBM PC.

An experimental trial was conducted by linking the IBM PC and the TRS-80 Model III together via their RS 232 I/O ports. A five-foot length RS 232 cable in series with a RS 232 null modem was used

to connect the two computers. The objective was to transfer programs and files saved in ACSII format on the TRS-80 Model III TRS-DOS floppy disk to the IBM PC-DOS floppy disk using Videotex and the PC-Dial as the communication packages. One of the first problems encountered was the setting of parameters for the Videotex program to establish data carrier between the two systems. Once these parameters had been established a discovery was made that the buffer was limited to only accept a space of approximately fifty records. This involved the laborious process of breaking up and transmitting the records in 50-item blocks involving resetting the system each time. Once the programs and files had been transferred, several changes had to be made in order for the programs to execute on the IBM-PC. There were some differences in the TRS-80 BASIC and the IBM-PC BASIC.

Even though the process is very tedious and laborious, information on a disk from a particular manufacturer's computer with its specific disk operating system may be transferred to another noncompatible system through a null modem and communication software.

### Conclusions

The following conclusions were drawn based on the findings of the study:

1. The mathematical skills required for mastery by potential vocational educational students into Kentucky area state vocational schools are computational skills involving the four functions of

arithmetic, conceptual skills involving numeration systems, geometry, sets and monetary place value, and problem solving.

2. Each item pool showed content validity and had a high positive coefficient of reliability using the Hoyt reliability correlation formula.

3. Each skill pool showed items having no significant difference in their level of difficulty.

4. The diagnostic instrument showed a strong positive reliability coefficient with an average of .95 over the three randomly generated forms used in the normalization process.

5. There was no significant difference between the normalization skill level mean scores of the diagnostic instrument and the TABE in determining instrument validity.

6. There was no significant difference between the sample group's diagnostic instrument mean and the statewide Kentucky mean score of the TABE in mathematics.

7. There was a significant difference among the mean scores of the various skill categories of the diagnostic instrument. Basic addition tended to have the highest scores with percentage and fractional skills having the lowest.

8. There was a significant difference between the experimental pretest and experimental posttest scores using the computerized tutorial package as the variable where no significant difference existed within the control group.

### Recommendations

The following recommendations were made as a request of this study:

1. Educators should be aware of the availability of microcomputers in the classroom and begin to design the curriculum around the electronic text.
2. Developed software for computer-assisted instruction should use item pools or random generating features insuring that the learner has statistically equivalent but different items each time the software is executed.
3. All developed computer software should be field tested, validated and normalized before incorporation into the curriculum.
4. Due to the many complex problems of incompatibility between computer hardware and software it is recommended that educators use care when planning the curriculum around computer-assisted instruction.
5. Remediation and basic skill enhancement in mathematics can be effectively achieved through computer-assisted instruction giving the learner an individualized vehicle for self improvement. Educators should be aware that individual differences and individualized educational plans can be accounted for and managed via computer assisted and computer managed instruction.
6. Further research may be conducted using the same computer programs but substituting different items using a similar format.

7. Future computerized standardized objective tests should be designed around the validated "item pool" concept having the capability of generating many statistically equivalent pretests and posttests for experimental and analysis purposes.

8. Since there is statistical equivalence between the skills addressed in the diagnostic instrument and tutorial packages to those of the public schools grades four through eight, it is suggested that the diagnostic instrument and tutorial package be incorporated into the curriculum at the appropriate level.

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## APPENDICES

APPENDIX A  
DIAGNOSTIC INSTRUMENT COMPUTER PROGRAM  
WITH ITEM POOLS

```

5 CLEAR 500
10 CLS
20 PRINT "THE FOLLOWING MATHEMATICAL DIAGNOSTIC SOFTWARE PACKAGE"
30 PRINT "DEVELOPED UNDER THE AUSPICES OF THE KY. DEPT. OF EDUC."
40 PRINT "VOCATIONAL EDUCATION RESEARCH AND DEVELOPMENT UNIT"
50 PRINT "IS DESIGNED TO ASSIST VOCATIONAL EDUCATION STUDENTS"
60 PRINT "IN KENTUCKY WITH MASTERY OF BASIC MATH SKILLS"
70 PRINT @580,"THE FOLLOWING ASSESSMENT IS MULTIPLE CHOICE"
80 PRINT @644,"ENTER YOUR RESPONSE AS A,B,C,D OR E "
90 PRINT @772,"PLEASE PRESS ENTER TO CONTINUE"
95 INPUT Z$
100 X=75
110 CLS
120 INPUT "PLEASE ENTER YOUR NAME ";N$
130 DIM A$(10),B$(100),C$(100),D(100)
140 CLS
150 PRINT " (1) TAKE A PRACTICE TEST VIA THE COMPUTER "
160 PRINT " (2) TEACHER COPY OF A TEST WITH ANSWERS--80 COLMN.PRINTER"
170 PRINT " (3) TEACHER COPY OF A TEST WITH ANSWERS--132 COLMN. PRINTER"
180 INPUT " ENTER YOUR CHOICE AS 1, 2 OR 3 ";Y
190 ON Y GOTO 200 ,760 ,470
200 OPEN "R",1,"QUESTIONS"
210 FOR N=1 TO X
220 CLS
230 RANDOM
240 K=RND(5)+5*(N-1)
250 I=1
260 FIELD 1, 50 AS A$(I),50 AS A$(I+1),50 AS A$(I+2),50 AS A$(I+3),
265 REM (FIELD CONT.) 50 AS A$(I+4),1 AS A$(I+5)
270 GET 1,K
280 FOR C=1 TO 5
290 PRINT A$(C)
300 NEXT C
310 PRINT @ 710,"ENTER YOUR ANSWER TO THE ABOVE PROBLEM NUMBER ";N
320 INPUT B$(N)
330 C$(N)=A$(6)
340 NEXT N
350 CLOSE
360 L=L+1
370 IF L=X+1 THEN 410
380 IF B$(L)=C$(L) THEN 360
390 D(L)=L
400 GOTO 360
410 CLS
420 FOR K=1 TO X
430 IF D(K)=0 THEN 450
440 PRINT " YOU HAD AN ERROR IN PROBLEM #";K
450 NEXT K
460 END
470 OPEN "R",1,"QUESTIONS"

```

```

470 OPEN "R",1,"QUESTIONS"
480 OPEN "R",2,"QUESTIONS"
490 LPRINT" THE FOLLOWING PRACTICE PROBLEMS ARE FOR ";N$
500 FOR N=1 TO X STEP 2
510 CLS
520 RANDOM
530 K=RND(5)+5*(N-1)
540 L=RND(5)+5*N
550 I=1
560 FIELD 1, 50 AS A$(I),50 AS A$(I+1),50 AS A$(I+2),50 AS A$(I+3),
565 REM (FIELD 1,CONT.) 50 AS A$(I+4),1 AS A$(I+5)
570 FIELD 2, 50 AS B$(I),50 AS B$(I+1),50 AS B$(I+2),50 AS B$(I+3),
575 REM (FIELD 2,CONT.) 50 AS B$(I+4),1 AS B$(I+5)
580 GET 1,K
590 GET 2,L
600 LPRINT "PROBLEM NUMBER ";N;"          "; "PROBLEM NUMBER ";N+1
610 FOR C=1 TO 5
620 LPRINT A$(C);B$(C)
630 NEXT C
640 C$(N)=A$(6)
650 C$(N+1)=B$(6)
660 LPRINT
670 LPRINT
680 NEXT N
690 CLOSE
700 LPRINT CHR$(12)
710 LPRINT " THE FOLLOWING ARE ANSWERS FOR "N$;"'S PRACTICE PROBLEMS."
720 FOR M=1 TO X
730 LPRINT " THE ANSWER TO PROBLEM #";M;" IS ";C$(M)
740 NEXT M
750 END
760 OPEN "R",1,"QUESTIONS"
770 LPRINT" THE FOLLOWING PRACTICE PROBLEMS ARE FOR ";N$
780 FOR N=1 TO X
790 CLS
800 RANDOM
810 K=RND(5)+5*(N-1)
820 I=1
830 FIELD 1, 50 AS A$(I),50 AS A$(I+1),50 AS A$(I+2),50 AS A$(I+3),
835 REM (FIELD 1,CONT.) 50 AS A$(I+4),1 AS A$(I+5)
840 GET 1,K
850 LPRINT "  PROBLEM NUMBER ";N
860 FOR C=1 TO 5
870 LPRINT A$(C)
880 NEXT C
890 C$(N)=A$(6)
900 LPRINT
910 LPRINT
920 NEXT N
930 CLOSE
940 LPRINT CHR$(12)
950 LPRINT " THE FOLLOWING ARE ANSWERS FOR ";N$;"'S PRACTICE PROBLEMS."
960 FOR M=1 TO X
970 LPRINT " THE ANSWER TO PROBLEM #";M;" IS ";C$(M)
980 NEXT M
990 END

```

624	(A)341
+323	(B)927
-----	(C)301
	(D)947
	(E)NONE OF THESE

D

534	(A)739
+235	(B)301
-----	(C)870
	(D)361
	(E)NONE OF THESE

E

631	(A)767
+136	(B)765
-----	(C)507
	(D)766
	(E)NONE OF THESE

A

378	(A)859
+521	(B)257
-----	(C)899
	(D)878
	(E)NONE OF THESE

C

697	(A)900
+202	(B)899
-----	(C)809
	(D)495
	(E)NONE OF THESE

B

2,198	(A)10,952
1,937	(B) 9,952
6,512	(C) 9,651
+ 305	(D) 9,052
-----	(E)NONE OF THESE

A

2,503	(A)20,331
1,327	(B) 9,389
5,436	(C)20,341
+ 123	(D) 8,389
-----	(E)NONE OF THESE

B

5,329	(A)13,088
5,632	(B)11,068
1,795	(C)13,188
+ 432	(D)11,048
-----	(E)NONE OF THESE

C



7,934	(A)16,338
6,742	(B)15,338
3,218	(C)18,344
+ 444	(D)18,338
-----	(E)NONE OF THESE

D

8,031	(A)16,982
6,542	(B)17,981
3,112	(C)16,981
+ 297	(D)14,382
-----	(E)NONE OF THESE

E

$(-3)+(-5)=$   
 (A)-8  
 (B)2  
 (C)-2  
 (D)8      (E)NONE OF THESE

A

$(-9)+(-4)=$   
 (A)-5  
 (B)13  
 (C)5  
 (D)-7      (E)NONE OF THESE

E

$(-6)+(-3)=$   
 (A)9  
 (B)3  
 (C)-9  
 (D)-3      (E)NONE OF THESE

C

$(-7)+(-3)=$   
 (A)10  
 (B)-10  
 (C)4  
 (D)-4      (E)NONE OF THESE

B

$(-5)+(-5)=$   
 (A)0  
 (B)10  
 (C)-0  
 (D)-10      (E)NONE OF THESE

D

$(+7)+(-2)=$   
 (A)9  
 (B)-5  
 (C)5  
 (D)-9      (E)NONE OF THESE

C

$$(+8)+(-4)=$$

(A)4

(B)-12

(C)-4

(D)12

(E)NONE OF THESE

A

$$(+9)+(-3)=$$

(A)12

(B)-12

(C)-6

(D)5

(E)NONE OF THESE

E

$$(+6)+(-5)=$$

(A)-1

(B)-11

(C)11

(D)1

(E)NONE OF THESE

D

$$(+8)+(-3)=$$

(A)11

(B)5

(C)-11

(D)-5

(E)NONE OF THESE

B

\$43.27

(A)\$70.62

4.62

(B)\$69.62

14.58

(C)\$43.26

+ 8.15

(D)\$50.62

-----

(E)NONE OF THESE

A

\$37.26

(A)\$42.01

5.89

(B)\$62.01

12.32

(C)\$52.01

+ 6.54

(D)\$49.11

-----

(E)NONE OF THESE

B

\$65.36

(A)\$98.01

7.84

(B)\$78.01

18.36

(C)\$98.10

+ 6.54

(D)\$54.32

-----

(E)NONE OF THESE

C

\$39.62

(A)\$37.58

6.89

(B)\$27.58

18.71

(C)\$74.85

+ 9.36

(D)\$74.58

-----

(E)NONE OF THESE

D

\$75.21      (A)\$80.31  
    5.43      (B)\$92.70  
    13.21     (C)\$89.60  
 + 7.35      (D)\$62.60  
 -----  
              (E)NONE OF THESE

E

5 yd. 3 ft. 7 in.  
 +3 yd. 2 ft. 5 in.  
 -----

(A)8 yd. (B)10 yd. (C)8 yd.  
 (D)9 yd. 1 ft. 2 in. (E)NONE OF THESE

B

4 yd. 2 ft. 3 in.  
 +2 yd. 3 ft. 6 in.  
 -----

(A)7 yd. (B)6 yd. 9 in. (C)7 yd. 3 in.  
 (D)6 yd. 5 ft. (E)NONE OF THESE

E

5 yd. 7 ft. 8 in.  
 +3 yd. 1 ft. 5 in.  
 -----

(A)11YD.1IN. (B)8YD.6FT.13IN. (C)11YD.13IN.  
 (D)8YD.8FT.3IN. (E)NONE OF THESE

A

6YD. 2 FT. 5 IN.  
 +3YD. 2 FT. 9 IN.  
 -----

(A)9YD.5FT.4IN. (B)9YD.14IN. (C)10YD.5FT.  
 (D)9YD.5FT.2IN. (E)NONE OF THESE

D

3 YD. 2 FT. 8 IN.  
 +2 YD. 3 FT. 4 IN.  
 -----

(A)5YD.6FT.4IN. (B)5YD.5FT.4IN. (C)7YD.  
 (D)6YD. (E)NONE OF THESE

C

32.3 + 5.67 + .3212 + 5=

(A)43.2912  
 (B)42.3912  
 (C)38.6545  
 (D)38.6534      (E)NONE OF THESE

A

45.6 + 3.45 + .0321 + 7=

(A)42.3912  
 (B)56.0821  
 (C)48.0821  
 (D)55.0821      (E)NONE OF THESE

B

$32.7 + 6.32 + .0304 + 6 =$   
(A) 38.0504  
(B) 44.0354  
(C) 45.0504  
(D) 45.5004 (E) NONE OF THESE  
C

$63.2 + 7.13 + .0363 + 9 =$   
(A) 99.3663  
(B) 78.3663  
(C) 48.4213  
(D) 79.3663 (E) NONE OF THESE  
D

$49.6 + 8.75 + .0563 + 4 =$   
(A) 62.3014  
(B) 63.3014  
(C) 63.3014  
(D) 47.9324 (E) NONE OF THESE  
E

$.06 + .123 + .3076 =$   
(A) .4906  
(B) .4806  
(C) 4.906  
(D) 6.5906 (E) NONE OF THESE  
A

$.07 + .752 + .3142 =$   
(A) .1362  
(B) 1.1362  
(C) 11.362  
(D) 6.3251 (E) NONE OF THESE  
B

$.31 + .032 + .5046 =$   
(A) .3866  
(B) .8038  
(C) .8466  
(D) .8866 (E) NONE OF THESE  
C

$.62 + .031 + .5731 =$   
(A) 1.1031  
(B) .1224  
(C) 1.003  
(D) 1.2241 (E) NONE OF THESE  
D

$.05 + .541 + .5757 =$   
(A) 1.0557  
(B) 1.1557  
(C) 1.003  
(D) 1.0043 (E) NONE OF THESE  
E

$$1/3 + 1/3 =$$

- (A)  $1/6$
- (B)  $2/6$
- (C)  $2/3$
- (D)  $1/9$
- (E) NONE OF THESE

C

$$1/2 + 1/2 =$$

- (A)  $1/4$
- (B)  $1/2$
- (C) 0
- (D) 1
- (E) NONE OF THESE

D

$$1/5 + 1/5 =$$

- (A)  $2/5$
- (B)  $1/10$
- (C)  $1/25$
- (D)  $2/25$
- (E) NONE OF THESE

A

$$1/6 + 1/6 =$$

- (A)  $2/12$
- (B)  $1/3$
- (C)  $1/36$
- (D)  $1/18$
- (E) NONE OF THESE

E

$$1/7 + 1/7 =$$

- (A)  $1/49$
- (B)  $2/49$
- (C)  $1/14$
- (D)  $2/14$
- (E) NONE OF THESE

E

$$1/4 + 1/8 =$$

- (A)  $1/2$
- (B)  $3/8$
- (C)  $5/8$
- (D)  $2/12$
- (E) NONE OF THESE

B

$$1/3 + 1/6 =$$

- (A)  $2/9$
- (B)  $1/18$
- (C)  $1/9$
- (D)  $1/3$
- (E) NONE OF THESE

E

$$1/2 + 1/4 =$$

- (A)  $3/4$
- (B)  $2/6$
- (C)  $1/3$
- (D)  $5/8$
- (E) NONE OF THESE

A

$$1/6 + 1/12 =$$

- (A)  $1/3$   
 (B)  $1/2$   
 (C)  $1/4$   
 (D)  $2/3$       (E) NONE OF THESE

C

$$2/7 + 3/7 =$$

- (A)  $5/49$   
 (B)  $6/49$   
 (C)  $6/7$   
 (D)  $5/7$       (E) NONE OF THESE

D

$$\begin{array}{r} 6 \frac{1}{3} \\ + 5 \frac{3}{4} \\ \hline \end{array}$$

(A)  $12 \frac{1}{12}$   
 (B)  $11 \frac{4}{7}$   
 (C)  $12 \frac{1}{12}$   
 (D)  $11 \frac{7}{12}$   
 (E) NONE OF THESE

A

$$\begin{array}{r} 13 \frac{1}{4} \\ + 2 \frac{1}{3} \\ \hline \end{array}$$

(A)  $11 \frac{7}{12}$   
 (B)  $15 \frac{7}{12}$   
 (C)  $15 \frac{2}{7}$   
 (D)  $15 \frac{1}{12}$   
 (E) NONE OF THESE

B

$$\begin{array}{r} 10 \frac{2}{7} \\ + 3 \frac{1}{2} \\ \hline \end{array}$$

(A)  $13 \frac{1}{5}$   
 (B)  $13$   
 (C)  $13 \frac{11}{14}$   
 (D)  $13 \frac{1}{14}$   
 (E) NONE OF THESE

C

$$\begin{array}{r} 16 \frac{2}{3} \\ + 5 \frac{1}{4} \\ \hline \end{array}$$

(A)  $21 \frac{1}{4}$   
 (B)  $11 \frac{11}{12}$   
 (C)  $21 \frac{3}{7}$   
 (D)  $21 \frac{11}{12}$   
 (E) NONE OF THESE

D

$$\begin{array}{r} 18 \frac{1}{3} \\ + 5 \frac{1}{2} \\ \hline \end{array}$$

(A)  $13 \frac{5}{6}$   
 (B)  $23 \frac{2}{5}$   
 (C)  $23 \frac{1}{6}$   
 (D)  $23 \frac{1}{5}$   
 (E) NONE OF THESE

E

$$\begin{array}{r} 2 \frac{3}{4} \\ + 3 \frac{2}{3} \\ \hline \end{array}$$

(A)  $6 \frac{5}{12}$   
 (B)  $5 \frac{5}{12}$   
 (C)  $1 \frac{5}{12}$   
 (D)  $5 \frac{5}{7}$   
 (E) NONE OF THESE

A

$4 \frac{2}{3}$   
 $+6 \frac{3}{5}$   
 -----  
 (A)  $10 \frac{5}{8}$   
 (B)  $11 \frac{4}{15}$   
 (C)  $10 \frac{4}{14}$   
 (D)  $1 \frac{4}{15}$   
 (E) NONE OF THESE

B

$5 \frac{3}{7}$   
 $+4 \frac{5}{6}$   
 -----  
 (A)  $9 \frac{8}{13}$   
 (B)  $9 \frac{8}{42}$   
 (C)  $10 \frac{11}{42}$   
 (D)  $10 \frac{1}{13}$   
 (E) NONE OF THESE

C

$7 \frac{5}{8}$   
 $+4 \frac{3}{7}$   
 -----  
 (A)  $11 \frac{8}{15}$   
 (B)  $12 \frac{1}{18}$   
 (C)  $11 \frac{5}{8}$   
 (D)  $12 \frac{3}{56}$   
 (E) NONE OF THESE

D

$4 \frac{5}{8}$   
 $+6 \frac{5}{9}$   
 -----  
 (A)  $10 \frac{13}{72}$   
 (B)  $12 \frac{13}{72}$   
 (C)  $10 \frac{10}{17}$   
 (D)  $11 \frac{10}{17}$   
 (E) NONE OF THESE

E

378  
 -228  
 -----  
 (A) 606  
 (B) 150  
 (C) 140  
 (D) 590  
 (E) NONE OF THESE

B

989  
 -676  
 -----  
 (A) 313  
 (B) 393  
 (C) 1665  
 (D) 590  
 (E) NONE OF THESE

A

768  
 -145  
 -----  
 (A) 913  
 (B) 622  
 (C) 623  
 (D) 803  
 (E) NONE OF THESE

C

925  
 -701  
 -----  
 (A) 1626  
 (B) 823  
 (C) 203  
 (D) 226  
 (E) NONE OF THESE

E

742 (A)1381  
 -641 (B)1383  
 ----- (C)100  
 (D)101  
 (E)NONE OF THESE

D

92 (A)23  
 -69 (B)22  
 ---- (C)32  
 (D)33  
 (E)NONE OF THESE

A

76 (A)19  
 -67 (B)17  
 ---- (C)9  
 (D)16  
 (E)NONE OF THESE

C

82 (A)45  
 -47 (B)49  
 ---- (C)39  
 (D)35  
 (E)NONE OF THESE

D

98 (A)99  
 -19 (B)89  
 ---- (C)97  
 (D)87  
 (E)NONE OF THESE

E

78 (A)28  
 -49 (B)29  
 ---- (C)27  
 (D)19  
 (E)NONE OF THESE

B

8,705 (A)6,192  
 -2,993 (B)6,292  
 ----- (C)6,112  
 (D)5,812  
 (E)NONE OF THESE

E

7,603 (A)3,132  
 -4,471 (B)3,133  
 ----- (C)3,233  
 (D)3,223  
 (E)NONE OF THESE

A



6,907 (A)1,111  
 -5,998 (B)1,011  
 ----- (C)911  
 (D)909  
 (E)NONE OF THESE

D

2,004 (A)1,038  
 - 976 (B)1,138  
 ----- (C)1,028  
 (D)2,128  
 (E)NONE OF THESE

C

7,963 (A)6,084  
 -1,989 (B)5,974  
 ----- (C)5,074  
 (D)6,074  
 (E)NONE OF THESE

B

2,730 (A)750  
 -1,980 (B)839  
 ----- (C)1,840  
 (D)850  
 (E)NONE OF THESE

A

6,952 (A)4,158  
 -2,896 (B)4,058  
 ----- (C)4,056  
 (D)4,156  
 (E)NONE OF THESE

C

9,072 (A)2,176  
 -6,895 (B)2,186  
 ----- (C)3,176  
 (D)2,177  
 (E)NONE OF THESE

D

4,844 (A)2,987  
 -2,967 (B)1,877  
 ----- (C)2,877  
 (D)2,887  
 (E)NONE OF THESE

B

7,234 (A)1,838  
 -5,496 (B)2,838  
 ----- (C)1,938  
 (D)1,748  
 (E)NONE OF THESE

E

\$17.52 (A)\$12.66  
 - 5.96 (B)\$12.56  
 ----- (C)\$11.56  
 (D)\$11.66  
 (E)NONE OF THESE

C

\$12.52 (A)\$5.17  
 - 7.65 (B)\$4.87  
 ----- (C)\$5.87  
 (D)\$4.17  
 (E)NONE OF THESE

B

\$24.66 (A)\$16.70  
 - 7.96 (B)\$16.60  
 ----- (C)\$17.60  
 (D)\$17.50  
 (E)NONE OF THESE

A

\$19.86 (A)\$18.89  
 - 2.97 (B)\$17.89  
 ----- (C)\$16.89  
 (D)\$16.99  
 (E)NONE OF THESE

D

\$56.17 (A)\$5.77  
 -51.50 (B)\$5.76  
 ----- (C)\$5.66  
 (D)\$4.69  
 (E)NONE OF THESE

E

\$200.00 (A)\$185.50  
 - 14.75 (B)\$185.75  
 ----- (C)\$158.50  
 (D)\$185.25  
 (E)NONE OF THESE

D

\$158.65 (A)\$140.89  
 - 17.76 (B)\$141.89  
 ----- (C)\$140.99  
 (D)\$141.99  
 (E)NONE OF THESE

A

\$78.74 (A)\$76.25  
 - 2.59 (B)\$76.05  
 ----- (C)\$76.15  
 (D)\$75.04  
 (E)NONE OF THESE

C

\$296.00 (A)\$37.93  
 -158.17 (B)\$34.83  
 ----- (C)\$34.93  
 (D)\$37.83  
 (E)NONE OF THESE

E

\$483.66 (A)\$4.75  
 -476.91 (B)\$6.75  
 ----- (C)\$6.65  
 (D)\$7.65  
 (E)NONE OF THESE

B

6DY. 7HR. 30MIN. (A)1DY. 9HR. 40MIN.  
 -4DY. 21HR. 50MIN. (B)1DY. 9HR. 50MIN.  
 ----- (C)10DY. 17HR. 20MIN.  
 (D)10DY. 16HR. 80MIN.  
 (E)NONE OF THESE

A

5DY. 12HR. 25MIN. (A)8DY. 6HR. 10MIN.  
 -1DY. 17HR. 45MIN. (B)7DY. 30HR. 10MIN.  
 ----- (C)3DY. 18HR. 20MIN.  
 (D)3DY. 18HR. 40MIN.  
 (E)NONE OF THESE

D

8DY. 9HR. 20MIN. (A)4DY. 15HR. 15MIN.  
 -4DY. 17HR. 35MIN. (B)3DY. 15HR. 45MIN.  
 ----- (C)13DY. 3HR. 15MIN.  
 (D)12DY. 3HR. 15MIN.  
 (E)NONE OF THESE

B

4DY. 7HR. 10MIN. (A)3DY. 3HR. 0MIN.  
 -1DY. 5HR. 50MIN. (B)2DY. 1HR. 20MIN.  
 ----- (C)3DY. 2HR. 20MIN.  
 (D)2DY. 2HR. 20MIN.  
 (E)NONE OF THESE

E

6DY. 8HR. 50MIN. (A)2DY. 8HR. 55MIN.  
 -3DY. 9HR. 55MIN. (B)2DY. 9HR. 55MIN.  
 ----- (C)2DY. 22HR. 55MIN.  
 (D)3DY. 8HR. 55MIN.  
 (E)NONE OF THESE

C

2  $\frac{8}{9}$  (A)1  $\frac{7}{9}$   
 -1  $\frac{1}{9}$  (B)1  $\frac{4}{9}$   
 ----- (C)1  $\frac{6}{9}$   
 (D) $\frac{7}{9}$   
 (E)NONE OF THESE

A

$$\begin{array}{r} 12 \frac{3}{8} \\ - 6 \frac{7}{8} \\ \hline \end{array}$$

(A)  $5 \frac{3}{8}$   
 (B)  $5 \frac{1}{4}$   
 (C)  $5 \frac{1}{8}$   
 (D)  $5 \frac{1}{2}$   
 (E) NONE OF THESE

D

$$\begin{array}{r} 7 \frac{1}{5} \\ - 4 \frac{4}{5} \\ \hline \end{array}$$

(A)  $2 \frac{4}{5}$   
 (B)  $2 \frac{1}{5}$   
 (C)  $1 \frac{1}{5}$   
 (D)  $1 \frac{3}{5}$   
 (E) NONE OF THESE

E

$$\begin{array}{r} 9 \frac{1}{3} \\ - 2 \frac{2}{3} \\ \hline \end{array}$$

(A) 7  
 (B)  $6 \frac{2}{3}$   
 (C)  $6 \frac{1}{3}$   
 (D)  $7 \frac{2}{3}$   
 (E) NONE OF THESE

B

$$\begin{array}{r} 17 \frac{8}{9} \\ - 15 \frac{2}{9} \\ \hline \end{array}$$

(A) 2  
 (B)  $2 \frac{6}{9}$   
 (C)  $2 \frac{2}{3}$   
 (D)  $2 \frac{8}{9}$   
 (E) NONE OF THESE

C

$$\begin{array}{r} 5/6 \\ - 4/5 \\ \hline \end{array}$$

(A)  $1/5$   
 (B)  $1/6$   
 (C)  $1/30$   
 (D)  $29/30$   
 (E) NONE OF THESE

E

$$\begin{array}{r} 2/3 \\ - 1/2 \\ \hline \end{array}$$

(A)  $1/3$   
 (B) 1  
 (C)  $1/6$   
 (D)  $1 \frac{1}{3}$   
 (E) NONE OF THESE

C

$$\begin{array}{r} 3/4 \\ - 2/3 \\ \hline \end{array}$$

(A)  $1/12$   
 (B)  $1/4$   
 (C)  $1/3$   
 (D)  $5/12$   
 (E) NONE OF THESE

A

$$\begin{array}{r} 4/8 \\ - 2/3 \\ \hline \end{array}$$

(A)  $1 \frac{1}{6}$   
 (B)  $-1/6$   
 (C)  $+1/6$   
 (D)  $-1 \frac{1}{6}$   
 (E) NONE OF THESE

B

$\frac{4}{5}$  (A) -1  
 $-\frac{6}{7}$  (B) 1  
 ----- (C)  $+\frac{2}{35}$   
 (D)  $-\frac{2}{35}$   
 (E) NONE OF THESE

D

$\frac{3}{5}$  (A)  $\frac{7}{20}$   
 $-\frac{1}{4}$  (B)  $\frac{11}{20}$   
 ----- (C)  $\frac{17}{20}$   
 (D)  $\frac{2}{9}$   
 (E) NONE OF THESE

A

$\frac{4}{7}$  (A)  $\frac{3}{4}$   
 $-\frac{1}{3}$  (B)  $\frac{5}{21}$   
 ----- (C)  $\frac{4}{21}$   
 (D)  $\frac{1}{4}$   
 (E) NONE OF THESE

B

$\frac{3}{5}$  (A)  $\frac{1}{20}$   
 $-\frac{1}{8}$  (B)  $\frac{2}{3}$   
 ----- (C)  $\frac{19}{40}$   
 (D)  $\frac{3}{40}$   
 (E) NONE OF THESE

C

$\frac{5}{7}$  (A)  $\frac{5}{21}$   
 $-\frac{1}{3}$  (B) 1  
 ----- (C)  $1\frac{1}{21}$   
 (D)  $\frac{8}{21}$   
 (E) NONE OF THESE

D

$\frac{4}{5}$  (A)  $\frac{1}{4}$   
 $-\frac{1}{3}$  (B)  $1\frac{2}{15}$   
 ----- (C)  $\frac{7}{8}$   
 (D)  $\frac{3}{15}$   
 (E) NONE OF THESE

E

$44\frac{3}{8}$  (A)  $21\frac{2}{3}$   
 $-22\frac{5}{8}$  (B)  $20\frac{7}{8}$   
 ----- (C)  $20\frac{1}{2}$   
 (D)  $21\frac{1}{2}$   
 (E) NONE OF THESE

A

$67\frac{5}{6}$  (A)  $50\frac{2}{3}$   
 $-16\frac{1}{6}$  (B)  $51\frac{2}{3}$   
 ----- (C) 51  
 (D)  $51\frac{1}{3}$   
 (E) NONE OF THESE

B

$$\begin{array}{r} 20 \frac{5}{7} \\ - 9 \frac{2}{7} \\ \hline \end{array}$$

(A)  $-11 \frac{3}{7}$   
 (B)  $10 \frac{3}{7}$   
 (C)  $11 \frac{3}{7}$   
 (D)  $12 \frac{3}{7}$   
 (E) NONE OF THESE

C

$$\begin{array}{r} 114 \frac{1}{4} \\ - 69 \frac{3}{4} \\ \hline \end{array}$$

(A)  $51 \frac{1}{2}$   
 (B)  $51 \frac{3}{4}$   
 (C)  $51 \frac{1}{2}$   
 (D)  $44 \frac{1}{2}$   
 (E) NONE OF THESE

D

$$\begin{array}{r} 99 \frac{3}{5} \\ - 44 \frac{4}{5} \\ \hline \end{array}$$

(A)  $54 \frac{3}{5}$   
 (B)  $55 \frac{3}{5}$   
 (C) 55  
 (D)  $55 \frac{4}{5}$   
 (E) NONE OF THESE

E

$$57.90 - 7.0435 =$$

(A) 50.9565  
 (B) 50.9575  
 (C) 50.9665  
 (D) 50.9675  
 (E) NONE OF THESE

E

$$22.06 - 12.1236 =$$

(A) 9.9464  
 (B) 9.9364  
 (C) 9.9394  
 (D) 10.9364  
 (E) NONE OF THESE

B

$$76.67 - 29.4981 =$$

(A) 47.2819  
 (B) 47.1819  
 (C) 47.1729  
 (D) 47.1719  
 (E) NONE OF THESE

D

$$99.206 - 88.6779 =$$

(A) 10.5281  
 (B) 10.5381  
 (C) 10.5391  
 (D) 10.5291  
 (E) NONE OF THESE

A

$$44.80 - 44.8925 =$$

(A) 0.1075  
 (B) -1.0925  
 (C) -0.0925  
 (D) -0.1075  
 (E) NONE OF THESE

E

332 (A)337  
 X 5 (B)1,650  
 ---- (C)1,660  
 (D)1,750  
 (E)NONE OF THESE

C

1,076 (A)9,693  
 X 9 (B)9,963  
 ----- (C)14,584  
 (D)1,085  
 (E)NONE OF THESE

E

767 (A)2,301  
 X 3 (B)2,281  
 ---- (C)2,101  
 (D)1,100  
 (E)NONE OF THESE

A

446 (A)2,476  
 X 6 (B)2,676  
 ---- (C)2,646  
 (D)2,652  
 (E)NONE OF THESE

B

372 (A)2,970  
 X 8 (B)2,966  
 ---- (C)2,476  
 (D)2,976  
 (E)NONE OF THESE

D

762 (A)1,524  
 X 20 (B)1,424  
 ---- (C)14,240  
 (D)15,240  
 (E)NONE OF THESE

D

540 (A)8,440  
 X 16 (B)57,040  
 ---- (C)556  
 (D)3,580  
 (E)NONE OF THESE

E

616 (A)6,554  
 X 39 (B)23,824  
 ---- (C)24,024  
 (D)23,924  
 (E)NONE OF THESE

C

992 (A) 36,624  
 X 47 (B) 46,624  
 ---- (C) 1,039  
 (D) 10,912  
 (E) NONE OF THESE

B

242 (A) 21,780  
 X 90 (B) 21,680  
 ---- (C) 18,780  
 (D) 18,680  
 (E) NONE OF THESE

A

468 (A) 6,232  
 X 24 (B) 11,232  
 ---- (C) 7,132  
 (D) 6,132  
 (E) NONE OF THESE

B

648 (A) 14,904  
 X 23 (B) 14,804  
 ---- (C) 13,804  
 (D) 671  
 (E) NONE OF THESE

A

436 (A) 35,152  
 X 82 (B) 31,742  
 ---- (C) 35,762  
 (D) 35,752  
 (E) NONE OF THESE

D

550 (A) 16,100  
 X 32 (B) 17,100  
 ---- (C) 17,600  
 (D) 582  
 (E) NONE OF THESE

C

842 (A) 56,404  
 X 67 (B) 53,904  
 ---- (C) 60,810  
 (D) 60,910  
 (E) NONE OF THESE

E

5,230 (A) 5,938  
 X 708 (B) 3,602  
 ----- (C) 3,702,840  
 (D) 4,422  
 (E) NONE OF THESE

C



1,760 (A)424,160  
 X 241 (B)423,160  
 ----- (C)784,160  
 (D)783,160  
 (E)NONE OF THESE

A

5,150 (A)3,180,550  
 X 637 (B)3,280,550  
 ----- (C)3,270,550  
 (D)3,127,550  
 (E)NONE OF THESE

B

2,417 (A)1,146,141  
 X 473 (B)1,142,141  
 ----- (C)1,132,141  
 (D)1,032,141  
 (E)NONE OF THESE

E

9,012 (A)1,513,148  
 X 179 (B)1,620,148  
 ----- (C)9,191  
 (D)1,613,148  
 (E)NONE OF THESE

D

$(-4) \times 3 =$  (A)-12  
 (B)-7  
 (C)7  
 (D)12  
 (E)NONE OF THESE

A

$(-2) \times (-4) =$  (A)6  
 (B)-6  
 (C)8  
 (D)-8  
 (E)NONE OF THESE

C

$7 \times (-9) =$  (A)63  
 (B)16  
 (C)-16  
 (D)-63  
 (E)NONE OF THESE

D

$(-12) \times 2 =$  (A)-10  
 (B)-14  
 (C)24  
 (D)14  
 (E)NONE OF THESE

E

6 X (-6) = (A)36  
(B)-36  
(C)12  
(D)0  
(E)NONE OF THESE

B

4 YD. 1 FT. (A)17 YD. 1 FT.  
X 4 (B)16 YD. 2 FT.  
----- (C)16 YD. 1 FT.  
(D)19 YD. 1 FT.  
(E)NONE OF THESE

A

2 YD. 3 FT. (A)4 YD. 6 FT.  
X 2 (B)4 YD. 5 FT.  
----- (C)4 YD. 2 FT.  
(D)5 YD. 3 FT.  
(E)NONE OF THESE

E

6 YD. 4 FT. (A)22 YD. 0 FT.  
X 3 (B)18 YD. 12 FT.  
----- (C)19 YD. 8 FT.  
(D)21 YD. 0 FT.  
(E)NONE OF THESE

D

5 YD. 5 FT. (A)10 YD. 10 FT.  
X 2 (B)11 YD. 0 FT.  
----- (C)13 YD. 1 FT.  
(D)11 YD. 7 FT.  
(E)NONE OF THESE

C

7 YD. 6 FT. (A)28 YD. 10 FT.  
X 4 (B)36 YD. 0 FT.  
----- (C)28 YD. 4 FT.  
(D)32 YD. 4 FT.  
(E)NONE OF THESE

B

33.2 (A)1.0126  
X.305 (B)10.126  
----- (C)10.026  
(D)101.26  
(E)NONE OF THESE

B

.197 (A)1.50311  
X7.63 (B)15.311  
----- (C)1,503.11  
(D)150.311  
(E)NONE OF THESE

A

26.2  
X9.17  
-----  
(A)2,492.44  
(B)249.244  
(C)249.24  
(D)240.254  
(E)NONE OF THESE

D

.430  
X.616  
-----  
(A)2.6488  
(B)2.54880  
(C).25488  
(D)264.88  
(E)NONE OF THESE

E

12.4  
X52.6  
-----  
(A)6,522.4  
(B)651.24  
(C)652.24  
(D)642.24  
(E)NONE OF THESE

C

485.2  
X 4  
-----  
(A)485.6  
(B)1,620.8  
(C)1,640.8  
(D)1,940.8  
(E)NONE OF THESE

D

84.25  
X 6  
-----  
(A)505.5  
(B)505.2  
(C)504.2  
(D)484.2  
(E)NONE OF THESE

A

162.7  
X 9  
-----  
(A)1,444.3  
(B)146.43  
(C)1,464.3  
(D)144.43  
(E)NONE OF THESE

C

72.61  
X 7  
-----  
(A)50.827  
(B)508.27  
(C)498.27  
(D)49.827  
(E)NONE OF THESE

B

6.164  
X 5  
-----  
(A)6.169  
(B)3.082  
(C)30.8  
(D)30.28  
(E)NONE OF THESE

E

$6 \times \frac{1}{5} =$  (A)  $1 \frac{1}{5}$   
(B)  $6 \frac{1}{5}$   
(C)  $\frac{5}{6}$   
(D)  $\frac{6}{5}$   
(E) NONE OF THESE

A

$7 \times \frac{1}{8} =$  (A)  $7 \frac{1}{8}$   
(B)  $1 \frac{1}{8}$   
(C)  $\frac{7}{8}$   
(D)  $7 \frac{7}{8}$   
(E) NONE OF THESE

C

$2 \times \frac{1}{2} =$  (A)  $2 \frac{1}{2}$   
(B)  $2 \frac{1}{4}$   
(C) 4  
(D) 1  
(E) NONE OF THESE

D

$9 \times \frac{3}{5} =$  (A)  $9 \frac{3}{5}$   
(B)  $5 \frac{2}{5}$   
(C)  $5 \frac{3}{5}$   
(D)  $9 \frac{2}{5}$   
(E) NONE OF THESE

B

$8 \times \frac{2}{3} =$  (A)  $8 \frac{2}{3}$   
(B)  $\frac{2}{3}$   
(C) 5  
(D)  $5 \frac{2}{3}$   
(E) NONE OF THESE

E

$\frac{1}{3} \times \frac{1}{3} =$  (A)  $\frac{1}{9}$   
(B)  $\frac{2}{9}$   
(C)  $\frac{1}{3}$   
(D) 1  
(E) NONE OF THESE

A

$\frac{1}{4} \times \frac{1}{4} =$  (A)  $\frac{1}{2}$   
(B)  $\frac{1}{16}$   
(C)  $\frac{1}{4}$   
(D) 1  
(E) NONE OF THESE

B

$\frac{2}{3} \times \frac{1}{3} =$  (A) 2  
(B) 1  
(C)  $\frac{2}{9}$   
(D) 0  
(E) NONE OF THESE

C

$1/5 \times 1/5 =$  (A)  $1/5$   
(B) 0  
(C) 1  
(D)  $1/25$   
(E) NONE OF THESE

D

$3/5 \times 1/5 =$  (A)  $3/5$   
(B)  $2/5$   
(C) 0  
(D) 1  
(E) NONE OF THESE

E

$5/8 \times 4/5 =$  (A)  $1/2$   
(B)  $9/40$   
(C)  $9/13$   
(D)  $1 \frac{7}{13}$   
(E) NONE OF THESE

A

$2/3 \times 5/6 =$  (A)  $7/9$   
(B)  $1 \frac{1}{9}$   
(C)  $1 \frac{7}{8}$   
(D)  $5/9$   
(E) NONE OF THESE

D

$7/8 \times 3/4 =$  (A)  $5/16$   
(B)  $21/32$   
(C)  $1 \frac{3}{4}$   
(D)  $1 \frac{1}{2}$   
(E) NONE OF THESE

B

$1/2 \times 5/9 =$  (A)  $2/9$   
(B)  $6/11$   
(C)  $5/18$   
(D)  $9/10$   
(E) NONE OF THESE

C

$3/4 \times 6/7 =$  (A)  $19/14$   
(B)  $9/28$   
(C)  $1 \frac{9}{11}$   
(D)  $21/24$   
(E) NONE OF THESE

E

$2 \frac{3}{5} \times 2/3 =$  (A) 1  
(B)  $1 \frac{11}{15}$   
(C)  $2 \frac{5}{8}$   
(D)  $3 \frac{5}{8}$   
(E) NONE OF THESE

B

$6 \frac{7}{8} \times 3 \frac{3}{4} =$  (A)  $5 \frac{5}{32}$   
 (B)  $6 \frac{11}{12}$   
 (C)  $7 \frac{11}{12}$   
 (D) 5  
 (E) NONE OF THESE

A

$8 \frac{5}{9} \times 1 \frac{2}{3} =$  (A)  $9 \frac{12}{27}$   
 (B)  $12 \frac{12}{27}$   
 (C)  $14 \frac{7}{12}$   
 (D)  $9 \frac{7}{12}$   
 (E) NONE OF THESE

C

$5 \frac{5}{6} \times 3 \frac{4}{5} =$  (A)  $8 \frac{9}{11}$   
 (B)  $9 \frac{9}{11}$   
 (C)  $8 \frac{9}{30}$   
 (D)  $22 \frac{1}{6}$   
 (E) NONE OF THESE

D

$3 \frac{3}{4} \times 7 \frac{7}{9} =$  (A)  $4 \frac{10}{13}$   
 (B)  $2 \frac{7}{12}$   
 (C)  $4 \frac{2}{13}$   
 (D)  $4 \frac{2}{5}$   
 (E) NONE OF THESE

E

-----  
 4) 428 (A) 17  
 (B) 42  
 (C) 107  
 (D) 177  
 (E) NONE OF THESE

C

-----  
 3) 369 (A) 123  
 (B) 321  
 (C) 183  
 (D) 133  
 (E) NONE OF THESE

A

-----  
 3) 687 (A) 244  
 (B) 229  
 (C) 684  
 (D) 249  
 (E) NONE OF THESE

B

-----  
 6) 246 (A) 46  
 (B) 32  
 (C) 31  
 (D) 41  
 (E) NONE OF THESE

D

-----  
5)355  
E  
(A)172  
(B)72  
(C)61  
(D)51  
(E)NONE OF THESE

-----  
300)6,000  
A  
(A)20  
(B)22  
(C)32  
(D)200  
(E)NONE OF THESE

-----  
50)2,500  
B  
(A)51  
(B)50  
(C)52  
(D)48  
(E)NONE OF THESE

-----  
200)8,000  
E  
(A)600  
(B)60  
(C)400  
(D)45  
(E)NONE OF THESE

-----  
3,000)6,000  
C  
(A)20  
(B)21  
(C)2  
(D)3,000  
(E)NONE OF THESE

-----  
40)8,400  
D  
(A)21  
(B)2,100  
(C)24  
(D)210  
(E)NONE OF THESE

-----  
6)636  
B  
(A)116  
(B)106  
(C)61  
(D)166  
(E)NONE OF THESE

-----  
7)7,791  
A  
(A)1,113  
(B)121  
(C)721  
(D)1,021  
(E)NONE OF THESE

-----  
8)864  
  
C  
  
-----  
9)918  
  
D  
  
-----  
5)553  
  
E  
  
-----  
24)8,952  
  
B  
  
-----  
36)4,320  
  
A  
  
-----  
24)7,344  
  
C  
  
-----  
17)4,250  
  
D  
  
-----  
34)1,360  
  
E

(A)188  
(B)83  
(C)108  
(D)180  
(E)NONE OF THESE

(A)112  
(B)120  
(C)121  
(D)102  
(E)NONE OF THESE

(A)17  
(B)117  
(C)116  
(D)106  
(E)NONE OF THESE

(A)371  
(B)373  
(C)278  
(D)333  
(E)NONE OF THESE

(A)120  
(B)12  
(C)1,020  
(D)102  
(E)NONE OF THESE

(A)36  
(B)360  
(C)306  
(D)361  
(E)NONE OF THESE

(A)2,500  
(B)610  
(C)360  
(D)250  
(E)NONE OF THESE

(A)204  
(B)401  
(C)41  
(D)410  
(E)NONE OF THESE



-----  
85) 5,623  
  
B  
  
-----  
(A) 66 6/13  
(B) 66 13/85  
(C) 66  
(D) 65 13/85  
(E) NONE OF THESE

91

-----  
83) 7,756  
  
A  
  
-----  
(A) 93 37/83  
(B) 92 73/83  
(C) 93  
(D) 93 1/3  
(E) NONE OF THESE

-----  
42) 2,253  
  
C  
  
-----  
(A) 53 9/42  
(B) 53  
(C) 53 9/13  
(D) 54  
(E) NONE OF THESE

-----  
56) 3,754  
  
D  
  
-----  
(A) 67  
(B) 67 4/56  
(C) 68  
(D) 67 1/28  
(E) NONE OF THESE

-----  
57) 5,583  
  
E  
  
-----  
(A) 97 53/57  
(B) 97 17/25  
(C) 97  
(D) 96 54/57  
(E) NONE OF THESE

-----  
4) 12.84  
  
C  
  
-----  
(A) 16.84  
(B) 8.84  
(C) 3.21  
(D) 3.04  
(E) NONE OF THESE

-----  
5) 7.65  
  
B  
  
-----  
(A) 12.65  
(B) 1.53  
(C) 2.65  
(D) 1.13  
(E) NONE OF THESE

-----  
4) 9.24  
  
A  
  
-----  
(A) 2.31  
(B) 5.24  
(C) 2.6  
(D) 4.56  
(E) NONE OF THESE

-----  
3)5.49 (A)1.43  
(B)2.83  
(C)2.43  
(D)1.83  
(E)NONE OF THESE

D

-----  
2)6.63 (A)3.33  
(B)3.39  
(C)3.16  
(D)4.35  
(E)NONE OF THESE

E

---  
.03)9 (A)300  
(B)30  
(C).3  
(D)3.3  
(E)NONE OF THESE

A

---  
.03)6 (A)20  
(B)200  
(C).32  
(D)3.2  
(E)NONE OF THESE

B

---  
.02)8 (A)8.02  
(B).16  
(C)400  
(D)1.6  
(E)NONE OF THESE

C

---  
.05)5 (A).055  
(B)5.05  
(C)500  
(D)100  
(E)NONE OF THESE

D

---  
2.1)4.2 (A)2.1  
(B)6.3  
(C)8.42  
(D)20  
(E)NONE OF THESE

E

.  
3/8 - 3/8 = (A)9/64  
(B)1/3  
(C)1  
(D)9/16  
(E)NONE OF THESE

C

$\frac{3}{5} - \frac{3}{5} =$   
 (A)  $\frac{1}{3}$   
 (B)  $\frac{6}{10}$   
 (C)  $\frac{9}{25}$   
 (D) 1  
 (E) NONE OF THESE

D

$\frac{2}{5} - \frac{2}{5} =$   
 (A)  $\frac{4}{5}$   
 (B) 1  
 (C)  $\frac{2}{5}$   
 (D)  $\frac{4}{10}$   
 (E) NONE OF THESE

B

$\frac{3}{7} - \frac{3}{7} =$   
 (A) 1  
 (B)  $\frac{9}{7}$   
 (C)  $\frac{6}{7}$   
 (D)  $\frac{6}{14}$   
 (E) NONE OF THESE

A

$\frac{4}{9} - \frac{4}{9} =$   
 (A)  $\frac{8}{9}$   
 (B)  $\frac{8}{18}$   
 (C)  $\frac{4}{9}$   
 (D)  $\frac{1}{4}$   
 (E) NONE OF THESE

E

$\frac{2}{3} - \frac{1}{3} =$   
 (A) 2  
 (B) 3  
 (C)  $\frac{1}{2}$   
 (D)  $\frac{1}{3}$   
 (E) NONE OF THESE

A

$\frac{3}{5} - \frac{1}{5} =$   
 (A) 2  
 (B) 3  
 (C)  $\frac{1}{3}$   
 (D)  $\frac{1}{5}$   
 (E) NONE OF THESE

B

$\frac{4}{7} - \frac{1}{7} =$   
 (A) 2  
 (B) 3  
 (C) 4  
 (D)  $\frac{1}{4}$   
 (E) NONE OF THESE

C

$\frac{4}{5} - \frac{1}{5} =$   
 (A) 2  
 (B)  $\frac{4}{25}$   
 (C) 5  
 (D) 4  
 (E) NONE OF THESE

D

$$\frac{6}{7} \div \frac{1}{7} =$$

(A) 6/49  
(B) 7/14  
(C) 7  
(D) 1/7  
(E) NONE OF THESE

E

$$\frac{1}{3} \div 2 =$$

(A) 1/6  
(B) 6  
(C) 7  
(D) 1  
(E) NONE OF THESE

E

$$\frac{1}{4} \div 3 =$$

(A) 4/3  
(B) 3/4  
(C) 12  
(D) 1/12  
(E) NONE OF THESE

D

$$\frac{1}{7} \div 2 =$$

(A) 2/7  
(B) 7/2  
(C) 1/14  
(D) 14  
(E) NONE OF THESE

C

$$\frac{1}{5} \div 5 =$$

(A) 5  
(B) 1/25  
(C) 1  
(D) 1/10  
(E) NONE OF THESE

B

$$\frac{1}{9} \div 3 =$$

(A) 1/27  
(B) 1/3  
(C) 27  
(D) 4/9  
(E) NONE OF THESE

A

$$5 \div \frac{2}{3} =$$

(A) 7 1/2  
(B) 3 2/3  
(C) 5 2/3  
(D) 17/3  
(E) NONE OF THESE

A

$$7 \div \frac{3}{4} =$$

(A) 7 3/4  
(B) 9 1/3  
(C) 5 1/4  
(D) 2 1/2  
(E) NONE OF THESE

B

$$5 - \frac{4}{5} =$$

(A) 4  
(B)  $5 \frac{4}{5}$   
(C)  $6 \frac{1}{4}$   
(D)  $1 \frac{4}{5}$   
(E) NONE OF THESE

C

$$8 - \frac{2}{3} =$$

(A) 10  
(B)  $3 \frac{1}{3}$   
(C)  $5 \frac{1}{3}$   
(D) 12  
(E) NONE OF THESE

D

$$4 - \frac{5}{8} =$$

(A)  $2 \frac{1}{2}$   
(B) 10  
(C)  $4 \frac{5}{8}$   
(D)  $6 \frac{5}{8}$   
(E) NONE OF THESE

E

$$5 \frac{2}{3} - 3 \frac{1}{2} =$$

(A)  $15 \frac{2}{3}$   
(B)  $8 \frac{3}{5}$   
(C)  $2 \frac{3}{5}$   
(D)  $1 \frac{2}{3}$   
(E) NONE OF THESE

E

$$8 \frac{3}{4} - 2 \frac{1}{3} =$$

(A)  $3 \frac{3}{4}$   
(B)  $4 \frac{3}{7}$   
(C)  $4 \frac{1}{4}$   
(D)  $4 \frac{2}{7}$   
(E) NONE OF THESE

A

$$5 \frac{4}{7} - 2 \frac{3}{4} =$$

(A) 2  
(B)  $2 \frac{2}{77}$   
(C)  $2 \frac{7}{11}$   
(D)  $3 \frac{1}{77}$   
(E) NONE OF THESE

B

$$4 \frac{1}{2} - 3 \frac{2}{3} =$$

(A)  $1 \frac{1}{3}$   
(B)  $1 \frac{1}{6}$   
(C)  $1 \frac{5}{22}$   
(D)  $6 \frac{1}{3}$   
(E) NONE OF THESE

C

$$5 \frac{3}{4} - 1 \frac{1}{3} =$$

(A)  $5 \frac{1}{4}$   
(B)  $4 \frac{1}{4}$   
(C)  $6 \frac{4}{7}$   
(D)  $4 \frac{5}{16}$   
(E) NONE OF THESE

D

IF  $X+3=7$  THEN  $X=$  (A) 4  
 (B) 10  
 (C) 21  
 (D) 37  
 (E) NONE OF THESE

A

IF  $X+7=12$  THEN  $X=$  (A) 4  
 (B) 5  
 (C) 84  
 (D)  $1\frac{5}{7}$   
 (E) NONE OF THESE

B

IF  $X+4=9$  THEN  $X=$  (A) 49  
 (B)  $2\frac{1}{4}$   
 (C) 5  
 (D) 94  
 (E) NONE OF THESE

C

IF  $X+5=12$  THEN  $X=$  (A) 17  
 (B) 125  
 (C)  $2\frac{2}{5}$   
 (D) 7  
 (E) NONE OF THESE

D

IF  $X+3=10$  THEN  $X=$  (A) 30  
 (B) 13  
 (C) 8  
 (D) 103  
 (E) NONE OF THESE

E

WHICH OF THE FOLLOWING  
 NUMBERS HAS THE  
 GREATEST VALUE? (A)  $53\frac{1}{2}$   
 (B)  $35\frac{8}{9}$   
 (C)  $54\frac{1}{2}$   
 (D)  $55\frac{1}{7}$   
 (E)  $80\frac{1}{8}$

E

WHICH OF THE FOLLOWING  
 NUMBERS HAS THE  
 GREATEST VALUE? (A)  $63\frac{1}{2}$   
 (B)  $47\frac{2}{3}$   
 (C)  $54\frac{1}{2}$   
 (D)  $89\frac{1}{3}$   
 (E)  $88\frac{2}{3}$

D

WHICH OF THE FOLLOWING  
 NUMBERS HAS THE  
 GREATEST VALUE? (A)  $83\frac{1}{2}$   
 (B)  $89\frac{7}{9}$   
 (C)  $103\frac{2}{3}$   
 (D)  $99\frac{7}{8}$   
 (E)  $100\frac{8}{9}$

C

WHICH OF THE FOLLOWING  
NUMBERS HAS THE  
GREATEST VALUE?

- (A)  $89 \frac{7}{8}$
- (B)  $99 \frac{1}{5}$
- (C)  $64 \frac{7}{9}$
- (D)  $85 \frac{1}{2}$
- (E)  $96 \frac{2}{3}$

97

B

WHICH OF THE FOLLOWING  
NUMBERS HAS THE  
GREATEST VALUE?

- (A)  $89 \frac{7}{8}$
- (B)  $64 \frac{7}{9}$
- (C)  $85 \frac{1}{2}$
- (D)  $63 \frac{1}{2}$
- (E)  $87 \frac{9}{16}$

A

IF  $7X=49$  THEN  $X=$

- (A) 7
- (B) 49
- (C) 45
- (D) 42
- (E) NONE OF THESE

A

IF  $6X=42$  THEN  $X=$

- (A) 6
- (B) 7
- (C) 252
- (D) 136
- (E) NONE OF THESE

B

IF  $4X=12$  THEN  $X=$

- (A) 4
- (B) 8
- (C) 3
- (D) 48
- (E) NONE OF THESE

C

IF  $9X=27$  THEN  $X=$

- (A) 18
- (B) 36
- (C) 7
- (D) 3
- (E) NONE OF THESE

D

IF  $5X=35$  THEN  $X=$

- (A) 30
- (B) 5
- (C) 40
- (D) 175
- (E) NONE OF THESE

E

$(4+3) \times (8-3) =$

- (A) 35
- (B) 53
- (C) 12
- (D) 9
- (E) NONE OF THESE

A

$(2+4) \times (7-4) =$  (A)26  
(B)18  
(C)9  
(D)38  
(E)NONE OF THESE

B

$(3+5) \times (5-3) =$  (A)25  
(B)27  
(C)16  
(D)61  
(E)NONE OF THESE

C

$(3+4) \times (8-4) =$  (A)31  
(B)11  
(C)3  
(D)28  
(E)NONE OF THESE

D

$(4+5) \times (7-3) =$  (A)37  
(B)39  
(C)27  
(D)63  
(E)NONE OF THESE

E

THE ROMAN NUMERAL XI MEANS

(A)11  
(B)21  
(C)6  
(D)4 (E)NONE OF THESE

A

THE ROMAN NUMERAL IX MEANS

(A)11  
(B)9  
(C)6  
(D)4 (E)NONE OF THESE

B

THE ROMAN NUMERAL MC MEANS

(A)500  
(B)1,001  
(C)1,100  
(D)501 (E)NONE OF THESE

C

THE ROMAN NUMERAL CD MEANS

(A)500  
(B)45  
(C)450  
(D)400 (E)NONE OF THESE

D



THE ROMAN NUMERAL XIX MEANS

- (A)121  
(B)1,110  
(C)61  
(D)51 (E)NONE OF THESE

99

$6.21 \times 10^3 =$  (A)6,210  
(B)621  
(C)6.21  
(D)1,000  
(E)NONE OF THESE

A

$5.03 \times 10^2 =$  (A)5,030  
(B)503  
(C)100  
(D)150.3  
(E)NONE OF THESE

B

$6.07 \times 10^3 =$  (A)1,060.7  
(B)6,700  
(C)6,070  
(D)106.7  
(E)NONE OF THESE

C

$4.37 \times 10^2 =$  (A)104  
(B)1,437  
(C)437,100  
(D)437  
(E)NONE OF THESE

D

$8.02 \times 10^3 =$  (A)80.2  
(B)1,802  
(C)1,820  
(D)8,002  
(E)NONE OF THESE

E

ASSUME  $A*B$  MEANS  $A-B+2$  (A)4  
WHAT IS  $5*3$ ? (B)8  
(C)15  
(D)-1  
(E)NONE OF THESE

A

ASSUME  $A*B$  MEANS  $A+B-2$  (A)13  
WHAT IS  $5*3$ ? (B)6  
(C)5  
(D)15  
(E)NONE OF THESE

B

ASSUME  $P*Q$  MEANS  $Q-P+1$   
WHAT IS  $3*5$ ?

- (A)14
- (B)16
- (C)3
- (D)-1
- (E)NONE OF THESE

100

C

ASSUME  $P*Q$  MEANS  $PXQ+1$   
WHAT IS  $2*3$ ?

- (A)6
- (B)8
- (C)4
- (D)7
- (E)NONE OF THESE

D

ASSUME  $P*Q$  MEANS  $P-Q+1$   
WHAT IS  $2*3$ ?

- (A)5
- (B)4
- (C)3
- (D)1
- (E)NONE OF THESE

E

2  
3 = (A)9  
(B)6  
(C)33  
(D)22  
(E)NONE OF THESE

A

2  
6 = (A)26  
(B)36  
(C)66  
(D)8  
(E)NONE OF THESE

B

3  
3 = (A)6  
(B)0  
(C)27  
(D)39  
(E)NONE OF THESE

C

2  
7 = (A)27  
(B)5  
(C)14  
(D)49  
(E)NONE OF THESE

D

3  
5 = (A)35  
(B)8  
(C)2  
(D)243  
(E)NONE OF THESE

E

IF  $A=3$  AND  $B=4$ ,  
FIND THE VALUE OF  $X$   
WHICH MAKES THE  
FOLLOWING EQUATION  
TRUE.  $X=A-B+7$   
A (A)6  
(B)8  
(C)14  
(D)0  
(E)NONE OF THESE

IF  $A=5$  AND  $N=7$ ,  
FIND THE VALUE OF  $X$   
WHICH MAKES THE  
FOLLOWING EQUATION  
TRUE.  $X=A+3-N$   
B (A)537  
(B)1  
(C)35  
(D)9  
(E)NONE OF THESE

IF  $S=3$  AND  $T=4$ ,  
FIND THE VALUE OF  $A$   
WHICH MAKES THE  
FOLLOWING EQUATION  
TRUE.  $A=3+S-T$   
C (A)10  
(B)5  
(C)2  
(D)-24  
(E)NONE OF THESE

IF  $S=7$  AND  $T=6$ ,  
FIND THE VALUE OF  $X$   
WHICH MAKES THE  
FOLLOWING EQUATION  
TRUE.  $X=8-S+T$   
D (A)-5  
(B)5  
(C)-7  
(D)7  
(E)NONE OF THESE

IF  $A=4$  AND  $B=7$ ,  
FIND THE VALUE OF  $X$   
WHICH MAKES THE  
FOLLOWING EQUATION  
TRUE.  $X=12-A-B$   
E (A)23  
(B)128  
(C)15  
(D)-1  
(E)NONE OF THESE

IF  $X/5=5$ , THEN  $X=$   
A (A)25  
(B)5  
(C)1  
(D)55  
(E)NONE OF THESE

IF  $X/3=4$ , THEN  $X=$   
B (A)34  
(B)12  
(C)43  
(D)1/12  
(E)NONE OF THESE

IF  $X/6=6$ , THEN  $X=$   
C (A)66  
(B)1/66  
(C)36  
(D)1/36  
(E)NONE OF THESE

IF  $X/5=10$ , THEN  $X=$  (A)  $1/2$   
 (B) 2  
 (C) 7  
 (D) 50  
 (E) NONE OF THESE

D

IF  $X/9=9$ , THEN  $X=$  (A) 18  
 (B) 99  
 (C)  $1/18$   
 (D)  $1/2$   
 (E) NONE OF THESE

E

ASSUME  $X$  AND  $Y$  ARE TWO EVEN INTEGERS. WHICH OF THE FOLLOWING STATEMENTS ARE TRUE? (I)  $X-Y$  IS ZERO (II)  $X+Y$  IS EVEN (III)  $X-Y$  IS ODD (IV)  $Y-X$  IS EVEN (A) II AND IV ONLY (B) I AND III ONLY (C) I ONLY (D) II ONLY (E) II AND III ONLY

A

ASSUME  $X$  IS AN INTEGER AND  $X/5$  IS AN INTEGER. WHICH OF THE FOLLOWING ARE TRUE? (I)  $X$  IS ODD (II)  $X$  IS ZERO (III)  $X$  IS AN INTEGER (IV)  $X$  IS DIVISIBLE BY FIVE (A) I AND II ONLY (B) III AND IV ONLY (C) I ONLY (D) IV ONLY

B

ASSUME  $X$  AND  $Y$  ARE TWO ODD NUMBERS AND  $X+Y$  IS ZERO WHICH OF THE FOLLOWING STATEMENTS ARE TRUE? (I)  $X=Y$  (II)  $X-Y=0$  (III)  $XY$  IS ODD (IV)  $X$  IS THE NEGATIVE OF  $Y$  (A) I AND II ONLY (B) II AND III ONLY (C) III AND IV ONLY (D) I AND IV ONLY (E) II AND III

C

ASSUME  $X$  IS A POSITIVE INTEGER. WHICH OF THE FOLLOWING STATEMENTS ARE TRUE? (I)  $X$  IS ODD (II)  $X$  IS EVEN (III) 2 MULTIPLIED BY  $X$  IS EVEN (IV)  $X/X$  IS ONE (A) I AND II ONLY (B) I AND III ONLY (C) II AND IV ONLY (D) III AND IV ONLY (E) II AND IV ONLY

D

ASSUME  $X$  AND  $Y$  ARE EACH POSITIVE ODD INTEGERS. WHICH OF THE FOLLOWING STATEMENTS ARE TRUE? (I)  $X+Y$  IS ODD (II)  $X-Y$  IS ODD (III)  $XY$  IS EVEN (IV)  $XY$  IS ODD (A) I II ONLY (B) I AND III ONLY (C) II AND IV ONLY (D) III ONLY (E) IV ONLY

E

IF  $X/4=3/5$ , THEN  $X=$  (A)  $12/5$   
 (B) 8  
 (C) 2  
 (D)  $5/4$   
 (E) NONE OF THESE

A

IF  $X/5=3/7$ , THEN  $X=$  (A)  $7/15$   
 (B)  $15/7$   
 (C) 10  
 (D) 15  
 (E) NONE OF THESE

B

IF  $X/5=5/6$ , THEN  $X=$  (A) 3  
 (B)  $6/25$   
 (C)  $25/6$   
 (D) 4  
 (E) NONE OF THESE

C

IF  $X/3=4/9$ , THEN  $X=$  (A) 8  
 (B) 2  
 (C)  $3/4$   
 (D)  $4/3$   
 (E) NONE OF THESE

D

IF  $4/3=X/6$ , THEN  $X=$  (A) 12  
 (B) 10  
 (C) 24  
 (D)  $8/3$   
 (E) NONE OF THESE

E

THE SIGN  $>$  MEANS (A) GREATER THAN  
 (B) LESS THAN  
 (C) EQUAL  
 (D) REDUCE  
 (E) NONE OF THESE

A

THE SIGN  $<$  MEANS (A) PERCENT  
 (B) LESS THAN  
 (C) GREATER THAN  
 (D) EQUAL  
 (E) NONE OF THESE

B

THE SIGN  $=$  MEANS (A) REDUCE  
 (B) ADD  
 (C) EQUALS  
 (D) PERCENT  
 (E) NONE OF THESE

C

THE SIGN  $\sqrt[3]{\quad}$  MEANS (A) SQUARE ROOT  
 (B) DIVIDE  
 (C) SUBTRACT  
 (D) CUBE ROOT  
 (E) NONE OF THESE

D

THE SIGN + MEANS

- (A) SUBTRACT
- (B) DIVIDE
- (C) MULTIPLY
- (D) IS NOT DIVISION
- (E) NONE OF THESE

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E

HOW MANY MINUTES ARE  
EQUAL TO  $1\frac{1}{2}$  HOURS?

- (A) 90
- (B) 65
- (C) 150
- (D) 120
- (E) NONE OF THESE

A

HOW MANY MINUTES ARE  
EQUAL TO 5 HOURS AND  
10 MINUTES?

- (A) 70
- (B) 310
- (C) 510
- (D) 40
- (E) NONE OF THESE

B

HOW MANY MINUTES ARE  
EQUAL TO 2 HOURS AND  
30 MINUTES?

- (A) 100
- (B) 130
- (C) 150
- (D) 230
- (E) NONE OF THESE

C

HOW MANY MINUTES ARE  
EQUAL TO  $\frac{3}{4}$  OF AN  
HOUR?

- (A) 75
- (B) 34
- (C) 43
- (D) 45
- (E) NONE OF THESE

D

HOW MANY MINUTES ARE  
EQUAL TO 1 HOUR AND  
40 MINUTES?

- (A) 140
- (B) 70
- (C) 110
- (D) 101
- (E) NONE OF THESE

E

WHICH OF THE FOLLOWING  
SIDES OF A PARALLELOGRAM  
HAVE EQUAL MEASURES?

A/-----/B  
C/-----/D

- (A) AB, CD
- (B) AD, AC
- (C) CD, DB
- (D) AC, AB
- (E) NONE OF THESE

A

WHICH 2 SIDES HAVE EQUAL MEASURE?

A!-----!B

(A) CD, AC

!-----!

(B) AC, BD

C!-----!D

(C) AB, BD

(D) AC, CB

(E) NONE OF THESE

B

WHICH 2 SIDES HAVE EQUAL MEASURE?

- A!-----!C (A) AC, AB  
 ! ! (B) AD, CD  
 B!-----!D (C) AC, BD  
 (D) CD, BD (E) NONE OF THESE

C

WHICH 2 SIDES HAVE EQUAL MEASURE?

- A!-----!B (A) AC, AB  
 ! ! (B) AB, BD  
 C!-----!D (C) AD, BD  
 (D) AC, BD (E) NONE OF THESE

D

WHICH 2 SIDES HAVE EQUAL MEASURE?

- A!-----!C (A) AC, CD  
 ! ! (B) AD, AC  
 B!-----!D (C) BC, CD  
 (D) AB, BD (E) NONE OF THESE

E

WHICH OF THE FOLLOWING RULES SHOULD BE USED TO FIND THE AREA OF A CIRCLE? (A) DIVIDE THE DIA. BY 2 (B) SQUARE THE RAD. AND MUL. IT BY THE VALUE OF PI (C) DIV. THE CIRCUM. BY 2 PI (D) MULT. THE CIRCUM. BY THE RAD. (E) MULT. THE RAD. BY THE DIAMETER

B

WHICH OF THE FOLLOWING RULES SHOULD BE USED TO FIND THE AREA OF A SQUARE? (A) MULTIPLY 2 SIDES TOGETHER (B) ADD THE 4 SIDES (C) MULTIPLY PI BY THE RADIUS SQUARED (D) USE THE FORMULA  $1/2 \cdot B \cdot H$  (E) NONE OF THESE

A

WHICH OF THE FOLLOWING FORMULAE WILL GIVE THE AREA OF A RECTANGLE? (A) MULTIPLY THE RADIUS BY PI (B)  $1/2 \cdot B \cdot H$  (C) LENGTH TIMES WIDTH (D)  $4/3 \cdot \pi \cdot R$  (E) NONE OF THESE

C

WHICH OF THE FOLLOWING WILL GIVE THE CIRCUMFERENCE OF A CIRCLE? (A) MULTIPLY PI TIMES THE RADIUS SQUARED (B) DIVIDE THE DIAMETER BY 2 (C) ADD THE RAD. AND DIA. WITH PI (D) MULT. PI BY THE DIA. (E) NONE OF THESE

D

WHICH OF THE FOLLOWING CAN BE USED TO FIND THE RADIUS OF A CIRCLE? (A) MULTIPLY THE DIAMETER BY 2 (B) DIVIDE THE AREA BY THE CIRCUMFERENCE (C) DIVIDE THE AREA BY PI (D) ADD THE DIAMETER TO PI (E) NONE OF THESE

E

HOW MANY INCHES ARE EQUAL IN  
LENGTH TO  $1\frac{1}{2}$  FEET?

(A)18  
(B)15  
(C)12  
(D)12.5  
(E)NONE OF THESE

A

HOW MANY INCHES ARE EQUAL IN  
LENGTH TO 1 YARD 1 FOOT?

(A)11  
(B)48  
(C)24  
(D)36  
(E)NONE OF THESE

B

HOW MANY INCHES ARE EQUAL IN  
LENGTH TO  $2\frac{1}{3}$  FEET?

(A)23  
(B)20  
(C)28  
(D)27  
(E)NONE OF THESE

C

HOW MANY INCHES ARE EQUAL IN  
LENGTH TO  $1\frac{2}{3}$  FEET?

(A)18  
(B)21  
(C)15  
(D)20  
(E)NONE OF THESE

D

HOW MANY INCHES ARE EQUAL IN  
LENGTH TO  $2\frac{2}{3}$  FEET?

(A)8  
(B) $\frac{8}{3}$   
(C)29  
(D)30  
(E)NONE OF THESE

E

HOW MANY DEGREES ARE THERE  
IN THE MEASURE OF A CIRCLE?

(A)360  
(B)180  
(C)0  
(D)30  
(E)NONE OF THESE

A

HOW MANY DEGREES ARE THERE  
IN A RIGHT ANGLE?

(A)360  
(B)90  
(C)180  
(D)30  
(E)NONE OF THESE

B

WHICH OF THE FOLLOWING IS  
AN ACUTE ANGLE?

(A)360  
(B)90  
(C)30  
(D)180  
(E)NONE OF THESE

C



WHICH OF THE FOLLOWING IS  
AN OBTUSE ANGLE?

(A) 30  
(B) 60  
(C) 90  
(D) 130  
(E) NONE OF THESE

D

WHICH OF THE FOLLOWING IS  
COMPLEMENTARY TO A 37 DEGREE  
ANGLE?

(A) 30  
(B) 60  
(C) 90  
(D) 143  
(E) NONE OF THESE

E

WHICH OF THE FOLLOWING IS  
IS THE SHORTEST MEASUREMENT?

(A) 500 CENTIMETERS  
(B) 20 DECIMETERS  
(C) 1 METER  
(D) 5 METERS  
(E) 50 HECTOMETERS

A

WHICH OF THE FOLLOWING IS  
THE HEAVIEST WEIGHT?

(A) 3 MILLIGRAMS  
(B) 3 KILOGRAMS  
(C) 3 GRAMS  
(D) 3 CENTIGRAMS  
(E) 3 HECTOGRAMS

B

WHICH OF THE FOLLOWING IS  
THE LIGHTEST WEIGHT?

(A) 5 GRAMS  
(B) 5 HECTOGRAMS  
(C) 15 MILLIGRAMS  
(D) 5 KILOGRAMS  
(E) 5 CENTIGRAMS

C

WHICH OF THE FOLLOWING HAS  
THE GREATEST WEIGHT?

(A) 7 MILLIGRAMS  
(B) 7 CENTIGRAMS  
(C) 7 DECIGRAMS  
(D) 7 HECTOGRAMS  
(E) 7 GRAMS

D

WHICH OF THE FOLLOWING HAS  
THE GREATEST WEIGHT?

(A) 40 MILLIGRAMS  
(B) 400 CENTIGRAMS  
(C) 4 GRAMS  
(D) 40 DECIGRAMS  
(E) 4 DEKAGRAMS

E

WHAT IS THE AREA OF THE  
RECTANGLE BELOW? ( $A=BH$ )

!-----! 3 inches  
!-----!  
4 inches

(A) 12 SQUARE INCHES  
(B) 14 SQUARE INCHES  
(C) 7 SQUARE INCHES  
(D) 21 SQUARE INCHES  
(E) NONE OF THESE

A

WHAT IS THE AREA OF THE TRIANGLE BELOW? ( $A = \frac{1}{2}BH$ )

/! 7 inches  
/-!  
8 inches

(A) 15 SQUARE INCHES  
(B) 28 SQUARE INCHES  
(C) 24 SQUARE INCHES  
(D) 27 SQUARE INCHES  
(E) NONE OF THESE

B

WHAT IS THE AREA OF THE SQUARE BELOW? 2

!-----!  
! 3 in !  
!-----! (A=S )

(A) 15 SQUARE INCHES  
(B) 6 SQUARE INCHES  
(C) 9 SQUARE INCHES  
(D) 3 SQUARE INCHES  
(E) NONE OF THESE

C

WHAT IS THE AREA OF THE TRIANGLE BELOW? ( $A = \frac{1}{2}BH$ )

/! 6 inches  
/!  
/6in!

(A)  $36\sqrt{2}$  INCHES  
(B) 36 INCHES  
(C) 12 SQUARE INCHES  
(D) 18 SQUARE INCHES  
(E) NONE OF THESE

D

WHAT IS THE AREA OF THE FIGURE AT RIGHT IF ALL ANGLES ARE RIGHT ANGLES?

!----4 FT.----!  
!-----!  
(2FT.!)  
! 3 FT. !

(A) 10 SQ. FT.  
(B) 11 SQ. FT.  
(C) 14 SQ. FT.  
(D) 7 SQ. FT.  
(E) NONE OF THESE

A

WHAT IS THE AREA OF THE FIGURE (6 FT. BELOW IF ALL ANGLES ARE RIGHT ANGLES?)

!-----!  
!-----!  
!---3 FT.-!  
! 4 FT.-----! 1FT.

(A) 13 SQ. FT.  
(B) 9 SQ. FT.  
(C) 14 SQ. FT.  
(D) 19 SQ. FT.  
(E) NONE OF THESE

B

WHAT IS THE SQ. FT. AREA OF THE FIGURE, IF ALL ANGLES ARE RIGHT ANGLES?

!----4FT.---!  
!-----!  
(4FT.!)  
!-----!  
!-----6FT.-----!

(A) 15  
(B) 16  
(C) 18  
(1FT.)(D) 20  
(E) NONE

C

WHAT IS THE AREA IN SQ. CM OF THE FIGURE IF ALL ANGLES ARE RIGHT ANGLES?

!----!  
! (3CM)  
(4CM!) !---5CM---!  
!-----!  
!----10CM-----!

(A) 65  
(B) 40  
(C) 30  
(D) 25  
(E) NONE

D

WHAT IS THE AREA IN SQ. FT. OF THE FIGURE IF ALL ANGLES ARE RIGHT ANGLES?

!---5FT.---!  
!-----!  
(4FT.!)  
!-----!  
!---6FT.-----!

(A) 20  
(B) 24  
(C) 18  
(1FT.)(D) 16  
(E) NONE

E

TWO THOUSAND THREE IS THE  
SAME AS

(A) 2,003  
(B) 2,300  
(C) 2,030  
(D) 20,003  
(E) NONE OF THESE

A

TWENTY THOUSAND TWENTY-TWO  
IS THE SAME AS

(A) 2,222  
(B) 20,022  
(C) 20,002  
(D) 22,022  
(E) NONE OF THESE

B

FIFTY THOUSAND THIRTY-FIVE  
IS THE SAME AS

(A) 5,035  
(B) 53,500  
(C) 50,035  
(D) 530,500  
(E) NONE OF THESE

C

TWENTY-FOUR THOUSAND TWENTY-  
FOUR IS THE SAME AS

(A) 24,000  
(B) 24,240  
(C) 2,024  
(D) 24,024  
(E) NONE OF THESE

D

SIXTY THOUSAND FIFTY-FIVE  
IS THE SAME AS

(A) 65,065  
(B) 65,650  
(C) 60,650  
(D) 60,550  
(E) NONE OF THESE

E

TWO AND THREE TENTHS MEANS  
THE SAME AS

(A) 2.3  
(B) .23  
(C) 2.003  
(D) 2.03  
(E) NONE OF THESE

A

THREE AND TWO TENTHS MEANS  
THE SAME AS

(A) .32  
(B) 3.2  
(C) 3.002  
(D) 3.02  
(E) NONE OF THESE

B

FIVE AND THREE HUNDREDTHS  
MEANS THE SAME AS

(A) .53  
(B) 5.30  
(C) 5.03  
(D) 5.003  
(E) NONE OF THESE

C

SIX AND SIX HUNDREDTHS  
MEANS THE SAME AS

- (A) 6.006
- (B) .66
- (C) .066
- (D) 6.06
- (E) NONE OF THESE

110

D

TWENTY-FIVE HUNDREDTHS IS  
THE SAME AS

- (A) 2,500
- (B) .025
- (C) 2.05
- (D) .0025
- (E) NONE OF THESE

E

WHICH OF THE FOLLOWING MEANS  
THE SAME AS TWENTY-THREE  
DOLLARS AND FIVE CENTS?

- (A) \$23.05
- (B) \$23.5
- (C) 23.05
- (D) \$23.50
- (E) NONE OF THESE

A

WHICH OF THE FOLLOWING MEANS  
THE SAME AS FIFTY-SEVEN  
DOLLARS AND NINETEEN CENTS?

- (A) 57.19
- (B) \$57.19
- (C) \$5.719
- (D) 57.19 CENTS
- (E) NONE OF THESE

B

WHICH OF THE FOLLOWING MEANS  
THE SAME AS THIRTY-NINE  
DOLLARS AND THREE CENTS?

- (A) \$39.3 CENTS
- (B) 39.03
- (C) \$39.03
- (D) \$39.30
- (E) NONE OF THESE

C

WHICH OF THE FOLLOWING MEANS  
THE SAME AS SIXTY-THREE  
DOLLARS AND FOUR CENTS?

- (A) 63.04
- (B) 63.04 CENTS
- (C) \$63.40
- (D) \$63.04
- (E) NONE OF THESE

D

WHICH OF THE FOLLOWING MEANS  
THE SAME AS THIRTY-FIVE  
DOLLARS AND TWO CENTS?

- (A) 35.02
- (B) \$35.20
- (C) \$35.2
- (D) \$53.02
- (E) NONE OF THESE

E

3/1000 MEANS THE SAME AS

- (A) .003
- (B) .03
- (C) .3
- (D) 3,000
- (E) NONE OF THESE

A

5/100 MEANS THE SAME AS (A).5  
(B).05  
(C).005  
(D).55  
(E)NONE OF THESE

B

9/1000 MEANS THE SAME AS (A).9  
(B).09  
(C).009  
(D).0009  
(E)NONE OF THESE

C

13/1000 MEANS THE SAME AS (A)1.003  
(B).130  
(C).0013  
(D).013  
(E)NONE OF THESE

D

6/100 MEANS THE SAME AS (A)600  
(B).006  
(C).60  
(D).0006  
(E)NONE OF THESE

E

WHICH OF THE FOLLOWING (A)47.36  
NUMERALS HAS A 3 IN THE (B)321.4  
TENTH'S PLACE? (C)23.03  
(D)33.43  
(E)NONE OF THESE

A

WHICH OF THE FOLLOWING (A)32.53  
NUMERALS HAS A 5 IN THE (B)62.35  
HUNDREDTH'S PLACE? (C)537.23  
(D)33.23  
(E)NONE OF THESE

B

WHICH OF THE FOLLOWING (A)27.775  
NUMERALS HAS A 7 IN THE (B)7,437.2  
THOUSANDTH'S PLACE? (C)37.007  
(D)77.77  
(E)NONE OF THESE

C

WHICH OF THE FOLLOWING (A)3.47  
NUMERALS HAS A 4 IN THE (B)2.004  
HUNDREDTH'S PLACE? (C)423.42  
(D)7.74  
(E)NONE OF THESE

D

WHICH OF THE FOLLOWING NUMERALS HAS A 6 IN THE TEN'S PLACE?

(A)62.53  
(B)53.6  
(C)662.36  
(D)564.26  
(E)NONE OF THESE

E

WHICH OF THE FOLLOWING NUMBERS HAS THE GREATEST VALUE?

(A).73  
(B).123  
(C).09  
(D).009  
(E).100

A

WHICH OF THE FOLLOWING NUMBERS HAS THE GREATEST VALUE?

(A).39  
(B).40  
(C).123  
(D).041  
(E).090

B

WHICH OF THE FOLLOWING NUMBERS HAS THE GREATEST VALUE?

(A).060  
(B).009  
(C).53  
(D).065  
(E).099

C

WHICH OF THE FOLLOWING NUMBERS HAS THE GREATEST VALUE?

(A).009  
(B).030  
(C).045  
(D).32  
(E).032

D

WHICH OF THE FOLLOWING NUMBERS HAS THE GREATEST VALUE?

(A).01  
(B).09  
(C).001  
(D).009  
(E).10

E

ROUND .5327 TO THE NEAREST HUNDREDTH

(A).53  
(B).54  
(C).56  
(D).533  
(E)NONE OF THESE

A

ROUND .4552 TO THE NEAREST HUNDREDTHS

(A).45  
(B).46  
(C).455  
(D).50  
(E)NONE OF THESE

B

ROUND .7360 TO THE  
NEAREST HUNDREDTHS  
(A).736  
(B).80  
(C).74  
(D).70  
(E)NONE OF THESE

C

ROUND .7364 TO THE  
NEAREST TENTHS  
(A).74  
(B).77  
(C).736  
(D).7  
(E)NONE OF THESE

D

ROUND .5367 TO THE  
NEAREST THOUSANDTH  
(A).54  
(B).536  
(C).546  
(D).600  
(E)NONE OF THESE

E

ROUND 34.47 TO THE  
NEAREST TEN  
(A)30  
(B)34  
(C)35  
(D)40  
(E)NONE OF THESE

A

ROUND 26.06 TO THE  
NEAREST TEN  
(A)26  
(B)30  
(C)20  
(D)26.1  
(E)NONE OF THESE

B

ROUND 66.66 TO THE  
NEAREST TEN  
(A)67  
(B)66  
(C)70  
(D)66.7  
(E)NONE OF THESE

C

ROUND 93.33 TO THE  
NEAREST TEN  
(A)93  
(B)94  
(C)100  
(D)90  
(E)NONE OF THESE

D

ROUND 76.39 TO THE  
NEAREST TEN  
(A)76  
(B)77  
(C)70  
(D)76.4  
(E)NONE OF THESE

E

WHICH PAIR OF NUMBERS  
BELOW CONTAINS TWO  
FACTORS OF 18?  
(A)9,2  
(B)9,7  
(C)12,7  
(D)3,5  
(E)NONE OF THESE

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A

WHICH PAIR OF NUMBERS  
BELOW CONTAINS TWO  
FACTORS OF 63?  
(A)62,1  
(B)9,7  
(C)8,7  
(D)3,5  
(E)NONE OF THESE

B

WHICH PAIR OF NUMBERS  
BELOW CONTAINS TWO  
FACTORS OF 42?  
(A)5,4  
(B)3,5  
(C)3,7  
(D)7,5  
(E)NONE OF THESE

C

WHICH PAIR OF NUMBERS  
BELOW CONTAINS TWO  
FACTORS OF 12?  
(A)5,7  
(B)5,2  
(C)10,2  
(D)3,4  
(E)NONE OF THESE

D

WHICH PAIR OF NUMBERS  
BELOW CONTAINS TWO  
FACTORS OF 45?  
(A)7,5  
(B)3,7  
(C)2,7  
(D)7,7  
(E)NONE OF THESE

E

WHAT IS THE GREATEST  
COMMON DIVISOR OF  
9,18,27?  
(A)9  
(B)3  
(C)2  
(D)7  
(E)NONE OF THESE

A

WHAT IS THE LEAST COMMON  
MULTIPLE OF 9,18,27?  
(A)3  
(B)54  
(C)9  
(D)1  
(E)NONE OF THESE

B

WHAT IS THE GREATEST  
COMMON DIVISOR OF  
15,18,21?  
(A)5  
(B)2  
(C)3  
(D)7  
(E)NONE OF THESE

C



WHAT IS THE LEAST COMMON MULTIPLE OF 15,18,21?  
(A)60  
(B)105  
(C)5  
(D)315  
(E)NONE OF THESE

D

WHAT IS THE GREATEST COMMON DIVISOR OF 6,9,12?  
(A)2  
(B)6  
(C)9  
(D)36  
(E)NONE OF THESE

E

A CORNFIELD HAS 20 ROWS OF CORN WITH 50 PLANTS OF CORN PER ROW. IF CROWS ATE 42 PLANTS OF CORN HOW MANY PLANTS ARE LEFT?  
(A) 958 (B) 58 (C) 8 (D) 62  
(E) NONE OF THESE

A

A PARKING LOT CONTAINED 5 ROWS OF NEW CARS WITH 10 CARS IN EACH ROW. SIX CARS WERE SOLD AND REMOVED FROM THE LOT. HOW MANY CARS WERE LEFT?  
(A) 4 (B) 44 (C) 9 (D) 20  
(E) NONE OF THESE

B

A CLASSROOM HAS 5 ROWS OF DESKS WITH 7 DESKS IN EACH ROW. FOUR DESKS WERE REMOVED FROM THE ROOM. HOW MANY DESKS WERE LEFT?  
(A) 8 (B) 35 (C) 31 (D) 39  
(E) NONE OF THESE

C

A COAT HAD 4 POCKETS WITH 3 MARBLES IN EACH POCKET. FOUR MARBLES WERE REMOVED FROM A POCKET AND GIVEN AWAY. HOW MANY MARBLES WERE LEFT?  
(A) 0 (B) 3 (C) 16 (D) 8  
(E) NONE OF THESE

D

A PARKING LOT CONTAINS 7 SCHOOL BUSES WITH 30 SEATS ON EACH BUS. IF ONE SEAT IS REMOVED FROM EACH BUS, HOW MANY SEATS REMAIN?  
(A) 180 (B) 29 (C) 207 (D) 210  
(E) NONE OF THESE

E

A STUDENT BOUGHT A COMPUTER FOR \$400 AND PAID \$50 DOWN. THE REMAINDER WAS TO BE PAID IN 5 MONTHLY PAYMENTS. HOW MUCH WAS EACH PAYMENT?  
(A) \$70 (B) \$80 (C) \$10 (D) \$50  
(E) NONE OF THESE

A

A FAMILY BOUGHT A WASHING MACHINE FOR \$575 AND PAID \$75 DOWN. THE REST WAS TO BE PAID IN 10 EQUAL PAYMENTS. HOW MUCH WAS EACH PAYMENT?

- (A) \$100 (B) \$50 (C) \$75 (D) \$60  
(E) NONE OF THESE

B

A MAN BOUGHT A BOAT FOR \$1500. HE PAID \$300 DOWN AND WILL PAY THE REST IN 12 EQUAL PAYMENTS. HOW MUCH WILL EACH PAYMENT BE?

- (A) \$10 (B) \$120 (C) \$100 (D) \$240  
(E) NONE OF THESE

C

A CHILD BOUGHT A 20 POUND BAG OF DOGFOOD. THE FOOD IS TO BE FED TO A DOG IN 40 DAYS AS EQUAL HOW MANY POUNDS WILL EACH SERVING BE?

- (A) 2 (B) 1 (C) .2 (D) .5  
(E) NONE OF THESE

D

A TEACHER BOUGHT 300 PIECES OF CANDY AND GAVE 50 PIECES TO THE PRINCIPAL. THE TEACHER THEN DIVIDED THE REMAINDER EQUALLY AMONG 50 STUDENTS. HOW MANY PIECES DID EACH STUDENT RECEIVE? (A) 6 (B) 7 (C) 8 (D) 1 (E) NONE OF THESE

E

JOHN ! \* \* \* \* \* WHICH CHILD APPEARS TO  
MARY ! \* \* \* \* \* HAVE THE GREATEST WEIGHT  
SUE ! \* \* \* \* \* (A) JOHN (B) MARY  
HENRY ! \* \* \* \* \* (C) SUE (D) HENRY  
(LBS) !--20--40--60--80-100-(E) NONE OF THESE

D

400 ! \* WHICH CHILD APPEARS TO  
300 ! \* \* HAVE THE MOST PENNIES  
200 ! \* \* \* (A) JOHN (B) MARY  
100 ! \* \* \* \* (C) SUE (D) HENRY  
!-JOHN-MARY-SUE-HENRY (E) NONE OF THESE

B

OAK !\*\*\*\*\* WHICH TREE APPEARS TO  
CEDAR !\*\*\*\*\* HAVE THE GREATEST HEIGHT?  
POPLAR !\*\*\*\*\* (A) OAK (B) CEDAR  
ASH !\*\*\*\*\* (C) POPLAR (D) ASH  
(FEET) --20-40-60-80-100--(E) NONE OF THESE

A

40 ! \* WHICH DOG APPEARS TO  
30 ! \* \* \* HAVE THE GREATEST  
20 ! \* \* \* \* WEIGHT? (A) SPOT  
10 ! \* \* \* \* (B) SPIKE (C) BARKY  
(LBS)!-SPOT-SPIKE-BARKY-FIDO(D) FIDO (E)NONE

C

SPOT !\*\*\*\*\* WHAT APPEARS TO BE FIDO'S  
 BARKY !\*\*\*\*\* WEIGHT IN POUNDS?  
 SPIKE !\*\*\*\*\* (A) 40 (B) 60  
 FIDO !\*\*\* (C) 80 (D) 100  
 (LBS) !-20-40-60-80-(E) NONE OF THESE  
 E

HOW MANY SQUARE FEET ARE THERE IN A CLASSROOM 15  
 FEET WIDE AND 30 FEET LONG?  
 (A) 450 (B) 200  
 (C) 45 (D) 315  
 (E) NONE OF THESE  
 A

HOW MANY SQUARE FEET OF CARPET DOES IT TAKE TO  
 COVER A ROOM 20 FEET WIDE BY 30 FEET LONG?  
 (A) 60 (B) 600  
 (C) 50 (D) 500  
 (E) NONE OF THESE  
 B

HOW MANY SQUARE MILES ARE CONTAINED IN A  
 RECTANGULAR SHAPED RANCH WITH A WIDTH OF  
 3 MILES AND A LENGTH OF 6 MILES?  
 (A) 24 (B) 36 (C) 18 (D) 21  
 (E) NONE OF THESE  
 C

HOW MANY SQUARE FEET ARE THERE IN A SQUARE  
 PIECE OF CARPET THAT MEASURES 1 FOOT ON EACH  
 SIDE?  
 (A) 4 (B) 2 (C) 3 (D) 1  
 (E) NONE OF THESE  
 D

HOW MANY SQUARE FEET ARE THERE IN A SQUARE  
 STRIP OF CARPET 7 FEET ON EACH SIDE?  
 (A) 7 (B) 28  
 (C) 14 (D) 70  
 (E) NONE OF THESE  
 E

WHAT IS THE AREA OF A RECTANGLE WITH A WIDTH OF  
 10 INCHES AND A LENGTH OF 14 INCHES?  
 (A) 140 SQUARE INCHES (B) 1410 SQUARE INCHES  
 (C) 48 SQUARE INCHES (D) 24 SQUARE INCHES  
 (E) NONE OF THESE  
 A

WHAT IS THE AREA OF A RECTANGLE WITH A BASE OF  
 3 FEET AND AN ALTITUDE OF 5 FEET?  
 (A) 16 SQUARE FEET (B) 15 SQUARE FEET  
 (C) 34 SQUARE FEET (D) 8 SQUARE FEET  
 (E) NONE OF THESE  
 B

WHAT IS THE AREA OF A RECTANGLE WITH A BASE OF 6 FEET AND AN ALTITUDE OF 5 FEET?

- (A) 11 SQUARE FEET      (B) 22 SQUARE FEET  
(C) 30 SQUARE FEET      (D) 65 SQUARE FEET  
(E) NONE OF THESE

C

WHAT IS THE AREA OF A RECTANGLE WITH A BASE OF 7 INCHES AND AN ALTITUDE OF 10 INCHES?

- (A) 17 SQUARE INCHES      (B) 34 SQUARE INCHES  
(C) 170 SQUARE INCHES      (D) 70 SQUARE INCHES  
(E) NONE OF THESE

D

WHAT IS THE AREA OF A RECTANGLE WITH A BASE OF 15 INCHES AND AN ALTITUDE OF 5 INCHES?

- (A) 345 SQUARE INCHES      (B) 55 SQUARE INCHES  
(C) 65 SQUARE INCHES      (D) 20 SQUARE INCHES  
(E) NONE OF THESE

E

WHAT IS THE AREA OF A PARALLELOGRAM WITH A BASE OF 12 INCHES AND AN ALTITUDE OF 8 INCHES?

- (A) 96 SQUARE INCHES      (B)  $1\frac{1}{2}$  SQUARE INCHES  
(C) 20 SQUARE INCHES      (D) 196 SQUARE INCHES  
(E) NONE OF THESE

A

WHAT IS THE AREA OF A PARALLELOGRAM WITH A BASE OF 13 INCHES AND AN ALTITUDE OF 10 INCHES?

- (A) 65 SQUARE INCHES      (B) 130 SQUARE INCHES  
(C) 1.3 SQUARE INCHES      (D) 46 SQUARE INCHES  
(E) NONE OF THESE

B

WHAT IS THE AREA OF A PARALLELOGRAM WITH A BASE OF 8 INCHES AND AN ALTITUDE OF 10 INCHES?

- (A) 136 SQUARE INCHES      (B) 18 SQUARE INCHES  
(C) 80 SQUARE INCHES      (D) 180 SQUARE INCHES  
(E) NONE OF THESE

C

WHAT IS THE AREA OF A PARALLELOGRAM WITH A BASE OF 7 INCHES AND AN ALTITUDE OF 7 INCHES?

- (A) 77 SQUARE INCHES      (B) 28 SQUARE INCHES  
(C) 14 SQUARE INCHES      (D) 49 SQUARE INCHES  
(E) NONE OF THESE

D

WHAT IS THE AREA OF A PARALLELOGRAM WITH A BASE OF 20 INCHES AND AN ALTITUDE OF 7 INCHES?

- (A) 70 SQUARE INCHES      (B) 27 SQUARE INCHES  
(C) 54 SQUARE INCHES      (D) 270 SQUARE INCHES  
(E) NONE OF THESE

E

A BOX IS 8 CM LONG, 6 CM WIDE, AND 3 CM DEEP.  
WHAT IS THE VOLUME OF THE BOX IN CUBIC  
CENTIMETERS?

- (A) 144    (B) 17    (C) 109    (D) 863  
(E) NONE OF THESE

A

A CUBE MEASURES 3 FEET ALONG EACH EDGE. WHAT  
IS ITS VOLUME IN CUBIC FEET?

- (A) 9    (B) 27  
(C) 12    (D) 6  
(E) NONE OF THESE

B

A BOX IS 10 FEET LONG, 6 FEET WIDE, AND 3 FEET  
TALL. HOW MANY CUBIC FEET OF CORN WILL THE BOX  
HOLD?

- (A) 19    (B) 360    (C) 180    (D) 63  
(E) NONE OF THESE

C

A BOX IS 5 INCHES WIDE, 10 INCHES LONG, AND 4  
INCHES HIGH. HOW MANY CUBIC INCHES OF SAND WILL  
THE BOX HOLD?

- (A) 54    (B) 19    (C) 154    (D) 200  
(E) NONE OF THESE

D

A CUBE MEASURES 1 FOOT ALONG EACH EDGE. WHAT  
IS THE VOLUME OF THE CUBE IN CUBIC FEET?

- (A) 3    (B) 10  
(C) 144    (D) 1256  
(E) NONE OF THESE

E

THE SCALE ON A MAP IS THAT 1 INCH = 50 MILES.  
IF 2 TOWNS ARE  $4\frac{1}{2}$  INCHES APART ON THE MAP,  
HOW MANY MILES APART ARE THEY ON EARTH?

- (A) 225    (B) 430    (C)  $124\frac{1}{2}$     (D) 100  
(E) NONE OF THESE

A

ON A MAP THE SCALE IS  $\frac{1}{2}$  INCH = 100 MILES.  
IF 2 CITIES ARE 3 INCHES APART ON THE MAP,  
HOW FAR APART ARE THE CITIES ON EARTH?

- (A) 150    (B) 600    (C) 300    (D) 450  
(E) NONE OF THESE

B

THE SCALE ON A ROAD MAP IS  $\frac{1}{3}$  INCHES = 60 MILES.  
IF 2 POINTS ARE 2 INCHES APART ON THE MAP, HOW  
MANY MILES ARE THE POINTS APART?

- (A) 40    (B) 80    (C) 360    (D) 460  
(E) NONE OF THESE

C

A MAP'S SCALE IS 2 INCHES = 25 MILES. IF TWO CITIES ARE 1000 MILES APART, HOW MANY INCHES APART SHOULD THEY BE ON THE MAP?

- (A) 50 (B) 40 (C) 60 (D) 80  
(E) NONE OF THESE

D

ON A MAP,  $1/2$  INCH = 50 KILOMETERS. IF 2 CITIES ARE  $2\frac{1}{2}$  INCHES APART ON THE MAP, HOW MANY KILOMETERS APART ARE THE CITIES?

- (A) 100 (B) 200 (C) 300 (D) 500  
(E) NONE OF THESE

E

PAT SCORED A 90 ON A FIRST TEST, AN 80 ON A SECOND, AND A 70 ON A THIRD TEST. WHAT IS PAT'S AVERAGE SCORE ON THE 3 TESTS?

- (A) 80 (B) 75 (C) 85 (D) 70  
(E) NONE OF THESE

A

A RACE CAR DRIVER DROVE 120 MPH IN RACE 1, 130 MPH IN RACE 2, AND 110 MPH IN RACE 3. WHAT IS THE CAR'S AVERAGE SPEED FOR THE 3 RACES?

- (A) 118 MPH (B) 120 MPH (C) 125 MPH  
(D) 130 MPH (E) NONE OF THESE

B

A FARMER HAD 3 CANS OF MILK. CAN #1 WEIGHED 88 LBS., CAN #2 WEIGHED 92 LBS., AND CAN #3 WEIGHED 69 LBS. WHAT WAS THEIR AVERAGE WEIGHT?

- (A) 85 LBS. (B) 79 LBS. (C) 83 LBS.  
(D) 100 LBS. (E) NONE OF THESE

C

FIND THE AVERAGE WEIGHT OF 4 LOADS OF STONE. THE WEIGH BILLS WERE: LOAD 1 = 32 TONS, LOAD 2 = 35 TONS, LOAD 3 = 40 TONS, LOAD 4 = 43 TONS.

- (A) 38 TONS (B) 37 TONS (C) 39.5 TONS  
(D) 37.5 TONS (E) NONE OF THESE

D

ON MONDAY KIM COLLECTED 12 ROCKS, ON TUESDAY 13 ROCKS WERE FOUND, AND 8 ON WEDNESDAY. WHAT IS THE AVERAGE NUMBER FOUND OVER 3 DAYS?

- (A) 10 (B) 9 (C) 23 (D) 33  
(E) NONE OF THESE

E

HOW MUCH MONEY DID KIM EARN FROM A 30% COMMISSION OF \$300 WORTH OF SALES?

- (A) \$90 (B) \$100  
(C) \$30 (D) \$900  
(E) NONE OF THESE

A

A TENANT FARMER RECEIVES 35% FROM THE OWNER'S TOBACCO SALES. IF TOBACCO SOLD FOR \$6000, WHAT DID THE FARMER RECEIVE?

- (A) \$3,500 (B) \$2,100 (C) \$2,000  
(D) \$3,000 (E) NONE OF THESE

B

A CHILD RECEIVES 2% OF ITS PARENTS PAYCHECK FOR AN ALLOWANCE. WHAT IS THE ALLOWANCE FOR A \$300 PAYCHECK?

- (A) \$2.00 (B) \$5.00 (C) \$6.00  
(D) \$20.00 (E) NONE OF THESE

C

THE LOCAL SCOUTS RECEIVE A 60% COMMISSION ON THE SALE OF \$500 WORTH OF GARDEN SEEDS. WHAT DID THE SCOUTS EARN?

- (A) \$60 (B) \$160 (C) \$260  
(D) \$300 (E) NONE OF THESE

D

A TRUCKER RECEIVES 15% COMMISSION ON THE VALUE OF A HAUL. WHAT IS THE TRUCKER'S EARNINGS ON A \$3000 HAUL?

- (A) \$1,500 (B) \$500 (C) \$550  
(D) \$150 (E) NONE OF THESE

E

A PERSON WALKED A DISTANCE OF 6 MILES UP A MOUNTAIN. IF THIS WAS 30% OF THE DISTANCE, HOW FAR IS IT TO THE TOP?

- (A) 20 MILES (B) 18 MILES (C) 30 MILES  
(D) 60 MILES (E) NONE OF THESE

A

A STUDENT MISSED 20% OF THE ITEMS ON A TEST. IF 4 ITEMS WERE MISSED, HOW MANY ITEMS WERE ON THE TEST?

- (A) 40 (B) 20 (C) 100  
(D) 24 (E) NONE OF THESE

B

A HIKER DRANK 15 OUNCES OF WATER FROM A CONTAINER HAVING 60 OUNCES ORIGINALLY. WHAT PERCENTAGE REMAINS?

- (A) 85% (B) 60% (C) 75%  
(D) 15% (E) NONE OF THESE

C

A SOLDIER MISSED A TARGET 5 TIMES BUT HIT IT 95% OF THE TIME. HOW MANY HITS WERE MADE?

- (A) 98 (b) 90  
(C) 100 (D) 95  
(E) NONE OF THESE

D

A SOLDIER MISSED A TARGET 5 TIMES, BUT HIT IT 75% OF THE TIMES. HOW MANY SHOTS WERE FIRED TOTAL?

- (A) (B) 100 (C) 75  
(D) 25 (E) NONE OF THESE

E

A PERSON EARNED 8 1/2% INTEREST ON A SAVINGS ACCOUNT OF \$3000 FOR 1 YEAR. WHAT WERE THE EARNINGS?

- (A) \$255 (B) \$245 (C) \$385  
(D) \$85 (E) NONE OF THESE

A

HOW MUCH WAS PAID IN INTEREST AT 9% PER YEAR ON A LOAN TALLING \$2500?

- (A) \$250 (B) \$225  
(C) \$92.50 (D) \$109  
(E) NONE OF THESE

B

A REALTOR RECEIVED 15% COMMISSION ON A HOUSE SELLING FOR \$45,000. HOW MUCH MONEY WAS EARNED?

- (A) \$3,000 (B) \$1,500 (C) \$6,750  
(D) \$3,500 (E) NONE OF THESE

C

A PERSON PAID 35% OF THEIR \$20,000 GROSS INCOME IN FEDERAL TAXES. HOW MUCH WAS PAID IN TAXES?

- (A) \$700 (B) \$3,500  
(C) \$7,350 (D) \$7,000

(E) NONE OF THESE

D

A BANKER LOANED A FAMILY \$5,000 FOR 1 YEAR AT 7% INTEREST. HOW MUCH MONEY WILL THE FAMILY PAY IN INTEREST?

- (A) \$3,500 (B) \$750 (C) \$500  
(D) \$370 (E) NONE OF THESE

E

A CHILD HAD 45 PENNIES AND SPENT 15 OF THEM. WHAT PERCENT OF THE TOTAL REMAIN UNSPENT?

- (A) 66 2/3% (B) 30% (C) 75%  
(D) 25% (E) NONE OF THESE

A

A CHILD SPENT 15 OF 45 PENNIES. WHAT PERCENT OF THE TOTAL WAS SPENT?

- (A) 66 2/3% (B) 33 1/3%  
(C) 30% (D) 25%

(E) NONE OF THESE

B



A DOG HAD 350 FLEAS, AND LOST 50 SWIMMING  
A RIVER. WHAT PERCENTAGE OF FLEAS WERE LOST?

- (A) 17.3%      (B) 25.32%  
(C) 14.28%      (D) 50%  
(E) NONE OF THESE

C

A BOXER HAD 28 TEETH BUT LOST 7 IN A FIGHT.  
WHAT PERCENT OF THE TEETH REMAIN?

- (A) 21      (B) 85  
(C) 70      (D) 75  
(E) NONE OF THESE

D

A CHILD HAD \$15 BUT SPENT \$5 WATCHING A  
MOVIE. WHAT PERCENT OF THE TOTAL WAS  
SPENT?

- (A) 45%      (B) 15%      (C) 25%  
(D) 75%      (E) NONE OF THESE

E

A CHICKEN, A DUCK AND A PID ATE 75 POUNDS OF  
CORN. IF THE CHICKEN ATE 15 POUNDS, THE DUCK  
30 POUNDS, WHAT PERCENTAGE DID THE PID EAT?

- (A) 40%      (B) 30%      (C) 50%  
(D) 45%      (E) NONE OF THESE

A

THREE LITTLE PIGS ATE 60 POUNDS OF CORN. IF  
PIG #1 ATE 15 POUNDS, PIG #2 ATE 25 POUNDS,  
WHAT PERCENT DID PIG #3 EAT?

- (A) 20%      (B)  $33 \frac{1}{3} \%$       (C) 25%  
(D)  $66 \frac{2}{3} \%$       (E) NONE OF THESE

B

TOGETHER 3 PEOPLE LIFTED A 500 LB. PIANO. THE  
FIRST PERSON LIFTED 200 LBS., THE SECOND 200 LBS.  
WHAT PERCENT DID THE THIRD LIFT?

- (A) 40%      (B) 15%      (C) 20%  
(D)  $33 \frac{1}{3} \%$       (E) NONE OF THESE

C

THREE LITTLE PIGS ATE 50 LBS. OF CORN. PIT #1  
ATE 5 LBS., PIG #2 ATE 15 LBS. WHAT PERCENT  
DID PIG #1 EAT?

- (A) 5%      (B) 30%      (C) 60%  
(D) 10%      (E) NONE OF THESE

D

TOGETHER 3 PEOPLE LIFTED A 400 LB. PIANO.  
PERSON #1 LIFTED 150 LBS., PERSON #2 LIFTED  
150 LBS. WHAT PERCENT DID PERSON #3 LIFT?

- (A) 100%      (B) 150%      (C) 15%  
(D)  $33 \frac{1}{3} \%$       (E) NONE OF THESE

E

KIM BOUGHT A COAT AT 30% OFF SALE. WHAT WAS THE SALE PRICE, IF THE ORIGINAL PRICE WAS \$60?

124

- (A) \$42 (B) \$40 (C) \$30  
(D) \$57 (E) NONE OF THESE

A

PAT BOUGHT A CHAIR. THE LIST PRICE WAS \$200. IF THERE WAS A 25% DISCOUNT, WHAT WAS THE SELLING PRICE?

- (A) \$175 (B) \$150 (C) \$225  
(D) \$160 (E) NONE OF THESE

B

A PERSON BOUGHT SOME SHOES NORMALLY SELLING FOR \$80 AT A 25% OFF SALE. WHAT WAS THE SELLING PRICE OF THE SHOES?

- (A) \$60 (B) \$75 (C) \$55  
(D) \$60 (E) NONE OF THESE

C

KIM RECEIVED A 40% DISCOUNT ON A COAT NORMALLY SELLING FOR \$120. WHAT DID KIM PAY FOR THE COAT?

- (A) \$80 (B) \$100 (C) \$48  
(D) \$72 (E) NONE OF THESE

D

APPENDIX B  
TUTORIAL COMPUTER PROGRAM  
WITH ITEM POOLS

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10 X=21
20 EC=0
30 CLS
40 PRINT"PLEASE ENTER YOUR FIRST NAME."
50 INPUT N$
60 CLS
70 PRINT
80 PRINT "HELLO ";N$;", THIS TUTORIAL PACKAGE ALONG WITH "
90 PRINT "THE STUDENT REFERENCE MANUAL AVAILABLE IN YOUR VOCATIONAL"
100 PRINT"SCHOOL WILL ALLOW YOU TO MASTER NECESSARY MATH SKILLS."
110 PRINT
120 PRINT
130 INPUT"PRESS THE ENTER KEY TO CONTINUE";T$
140 PRINT"YOU MAY CHOOSE ONE OF THREE LEVELS FOR TUTOR PRACTICE."
150 PRINT"IF YOU MISS A PROBLEM, THE COMPUTER WILL AUTOMATICALLY"
160 PRINT"GENERATE ANOTHER PROBLEM OF THAT TYPE GIVING YOU A 2ND TRY."
170 PRINT"IF YOU MISS TWO EASY PROBLEMS IN A ROW THE COMPUTER WILL"
180 PRINT"REFER YOU TO THE PROPER PAGE IN THE STUDENT REFERENCE MANUAL"
190 PRINT"FOR FURTHER INTRODUCTORY STUDY."
200 INPUT"PRESS ENTER TO CONTINUE ";T$
210 CLS
220 PRINT
230 INPUT"ENTER THE LEVEL YOU WISH TO TRY AS 1 FOR EASY, 2 FOR MODERATE,
235 REM (230 CONT.) 3 FOR DIFFICULT."
240 LEVEL=L
250 DIM A$(10),B$(100),C$(100),D(100)
260 OPEN "R",1,"PRACTICE"
270 FOR N=1 TO X
280 RANDOM
290 FIELD 1, 50 AS A$(1),50 AS A$(2),50 AS A$(3),50 AS A$(4),
295 REM (FIELD 1,CONT.) 50 AS A$(5),1 AS A$(6)
300 K=RND(5)+5*(L-1)+15*(N-1)
310 GET 1,K
320 CLS
330 FOR C=1 TO 5
340 PRINT A$(C)
350 NEXT C
360 PRINT @ 710,"ENTER YOUR ANSWER TO THE ABOVE PROBLEM NUMBER ";N
370 INPUT B$(N)
380 C$(N)=A$(6)
390 IF B$(N)=C$(N) THEN 570
400 EC=EC+1
410 PRINT "YOU MISSED PROBLEM #";N;" ";N$
420 PRINT "PRESS ENTER TO REVIEW THIS PROBLEM WITH THE CORRECT ANSWER."
430 INPUT T$
440 CLS
450 FOR C=1 TO 6
460 PRINT A$(C)
470 NEXT C
480 PRINT @322,"<--- ANSWER"
490 PRINT
500 PRINT "YOU IN ERROR ENTERED ";B$(N);" FOR THE ANSWER."

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510 PRINT
520 PRINT
530 PRINT "PRESS ENTER FOR ANOTHER PROBLEM."
540 INPUT T$
550 IF EC=2 THEN 680
560 GOTO 280
570 CLS
580 PRINT N$;" YOU GOT PROBLEM NUMBER ";N;" , GOOD JOB!!!"
590 PRINT
600 FOR WT=1 TO 1000
610 NEXT WT
620 CLS
630 EC=0
640 L=LEVEL
650 NEXT N
660 CLOSE
670 END
680 IF L=1 THEN 760
690 L=L-1
700 CLS
710 PRINT "LET'S TRY A PROBLEM AT AN EASIER LEVEL #";L
720 FOR WT=1 TO 1000
730 NEXT WT
740 EC=0
750 GOTO 280
760 ON N GOTO 770,810,840,870,900,930,960,990,1020,1050,
765 REM (760 CONT.)1080,1110,1140,1170,1200,1230,1260,1290,
766 REM (760 CONT.)1320,1350,1380
770 PRINT "PRACTICE ON ADDITION OF WHOLE NUMBERS,"
780 PRINT "PAGE 4 OF THE STUDENT REFERENCE MANUAL"
790 INPUT"PRESS ENTER TO CONTINUE";T$
800 GOTO 620
810 PRINT "PRACTICE ON SUBTRACTION OF WHOLE AND SIGNED NOS."
820 PRINT "PAGE 58 OF THE STUDENT REFERENCE MANUAL"
830 GOTO 790
840 PRINT "PRACTICE ON MULTIPLICATION OF WHOLE AND SIGNED NOS."
850 PRINT "PAGE 5 AND PAGE 58 OF THE STUDENT REFERENCE MANUAL."
860 GOTO 790
870 PRINT "PRACTICE ON DIVISION OF WHOLE NUMBERS."
880 PRINT "PAGE 5 OF THE STUDENT REFERENCE MANUAL"
890 GOTO 790
900 PRINT "PRACTICE ON ADDITION OF DECIMALS AND MEASUREMENT."
910 PRINT "PAGE 5 AND PAGE 28 OF THE STUDENT REFERENCE MANUAL"
920 GOTO 790
930 PRINT "PRACTICE ON SUBTRACTION OF DECIMALS & MEASUREMENTS."
940 PRINT "PAGE 5 AND PAGE 28 OF THE STUDENT REFERENCE MANUAL"
950 GOTO 790
960 PRINT "PRACTICE ON MULTIPLICATION OF DECIMALS & MEAS."
970 PRINT "PAGE 5 AND PAGE 29 OF THE STUDENT REFERENCE MANUAL"
980 GOTO 790
990 PRINT "PRACTICE ON DIVISION OF DECIMALS."
1000 PRINT "PAGE 5 AND PAGE 29 OF THE STUDENT REFERENCE MANUAL"

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1010 GOTO 790
1020 PRINT "PRACTICE ON ADDITION OF FRACTIONS"
1030 PRINT "PAGE 16 OF THE STUDENT REFERENCE MANUAL"
1040 GOTO 790
1050 PRINT "PRACTICE ON SUBTRACTION OF FRACTIONS"
1060 PRINT "PAGE 17 OF THE STUDENT REFERENCE MANUAL"
1070 GOTO 790
1080 PRINT "PRACTICE ON MULTIPLICATION OF FRACTIONS"
1090 PRINT "PAGE 18 OF THE STUDENT REFERENCE MANUAL"
1100 GOTO 790
1110 PRINT "PRACTICE ON DIVISION OF FRACTIONS"
1120 PRINT "PAGE 18 OF THE STUDENT REFERENCE MANUAL"
1130 GOTO 790
1140 PRINT "PRACTICE ON NUMBER SYSTEMS AND NUMERATION"
1150 PRINT "PAGES 73-74, 79 OF THE STUDENT REFERENCE MANUAL"
1160 GOTO 790
1170 PRINT "PRACTICE ON SYMBOLS AND EXPRESSIONS"
1180 PRINT "PAGES 95-97 OF THE STUDENT REFERENCE MANUAL"
1190 GOTO 790
1200 PRINT "PRACTICE ON GEOMETRY AND MEASUREMENTS"
1210 PRINT "PAGES 93, 102-106 OF THE STUDENT REFERENCE MANUAL"
1220 GOTO 790
1230 PRINT "PRACTICE ON MONEY AND PLACE VALUE"
1240 PRINT "PAGE 28 AND PAGE 78 OF STUDENT REFERENCE MANUAL"
1250 GOTO 790
1260 PRINT "PRACTICE ON SETS"
1270 PRINT "PAGE 84-~ OF THE STUDENT REFERENCE MANUAL"
1280 GOTO 790
1290 PRINT "PRACTICE ON TWO-STEP OPERATION WORD PROBLEMS"
1300 PRINT "PAGE 73 OF THE STUDENT REFERENCE MANUAL"
1310 GOTO 790
1320 PRINT "PRACTICE ON GRAPHS"
1330 PRINT "PAGE 90 OF THE STUDENT REFERENCE MANUAL"
1340 GOTO 790
1350 PRINT "PRACTICE ON GEOMETRY"
1360 PRINT "PAGE 102 OF THE STUDENT REFERENCE MANUAL"
1370 GOTO 790
1380 PRINT "PRACTICE ON PERCENTAGE, RATIO AND AVERAGING"
1390 PRINT "PAGE 41 AND PAGE 49 OF STUDENT REFERENCE MANUAL"
1400 GOTO 790
```

6  
+7  
---  
(A) 13      (B) 12      (C) 8  
(D) 5      (E) NONE OF THESE  
A

9  
+6  
---  
(A) 13      (B) 15      (C) 8  
(D) 12      (E) NONE OF THESE  
B

3  
+4  
---  
(A) 5      (B) 12      (C) 7  
(D) 34      (E) NONE OF THESE  
C

5  
+5  
---  
(A) 0      (B) 25      (C) 55  
(D) 10      (E) NONE OF THESE  
D

6  
+8  
---  
(A) 10      (B) 68      (C) 48  
(D) 12      (E) NONE OF THESE  
E

24  
+13  
-----  
(A) 37      (B) 11      (C) 123  
(D) 73      (E) NONE OF THESE  
A

48  
+76  
-----  
(A) 132      (B) 124      (C) 114  
(D) 32      (E) NONE OF THESE  
B

75  
+26  
-----  
(A) 91      (B) 51      (C) 101  
(D) 911      (E) NONE OF THESE  
C

88  
+95  
-----  
(A) 173      (B) 185      (C) 13  
(D) 183      (E) NONE OF THESE  
D

79  
+43  
-----  
(A) 112      (B) 106      (C) 121  
(D) 76      (E) NONE OF THESE  
E

394            (A) 1441  
683            (B) 1341  
291            (C) 1431  
+ 73           (D) 2441  
-----  
(E) NONE OF THESE  
A

649            (A) 1013  
321            (B) 1213  
156            (C) 1253  
+ 87           (D) 1123  
-----  
(E) NONE OF THESE  
B

324            (A) 1315  
659            (B) 1305  
321            (C) 1415  
+111           (D) 1351  
-----  
(E) NONE OF THESE  
C

547            (A) 1438  
313            (B) 1528  
657            (C) 1634  
+ 21           (D) 1538  
-----  
(E) NONE OF THESE  
D

111            (A) 1321  
222            (B) 1332  
888            (C) 1422  
+101           (D) 1421  
-----  
(E) NONE OF THESE  
E

8  
-4  
-----  
(A) 4      (B) 2      (C) 12  
(D) 0      (E) NONE OF THESE  
A



$$\begin{array}{r} 6 \\ -9 \\ \hline \end{array}$$
 (A) 3      (B) -3      (C) 15  
 (D) 0      (E) NONE OF THESE  
 B

$$(-6) + 8 =$$
 (A) 14  
 (B) -2  
 (C) 2  
 (D) 3      (E) NONE OF THESE  
 C

$$\begin{array}{r} 9 \\ -3 \\ \hline \end{array}$$
 (A) 7      (B) -6      (C) 3  
 (D) 6      (E) NONE OF THESE  
 D

$$(-5) + (-5) =$$
 (A) 10  
 (B) -5  
 (C) 5  
 (D) 0      (E) NONE OF THESE  
 E

$$\begin{array}{r} 88 \\ -57 \\ \hline \end{array}$$
 (A) 31      (B) 21      (C) 145  
 (D) 41      (E) NONE OF THESE  
 A

$$\begin{array}{r} 67 \\ -57 \\ \hline \end{array}$$
 (A) 110      (B) 10      (C) 0  
 (D) 15      (E) NONE OF THESE  
 B

$$\begin{array}{r} 59 \\ -48 \\ \hline \end{array}$$
 (A) 117      (B) -11      (C) 11  
 (D) 12      (E) NONE OF THESE  
 C

$$\begin{array}{r} 97 \\ -56 \\ \hline \end{array}$$
 (A) 31      (B) 40      (C) 42  
 (D) 41      (E) NONE OF THESE  
 D

44  
-14  
---

(A) 10 (B) 20 (C) 0  
(D) 31 (E) NONE OF THESE  
E

97  
-89  
---

(A) 8 (B) 18 (C) 12  
(D) 22 (E) NONE OF THESE  
A

67  
-85  
---

(A) 12 (B) -18 (C) -12  
(D) 18 (E) NONE OF THESE  
B

90  
-87  
---

(A) -3 (B) 13 (C) 3  
(D) -13 (E) NONE OF THESE  
C

100  
-199  
---

(A) -11 (B) 11 (C) -111  
(D) -99 (E) NONE OF THESE  
D

163  
- 98  
-----

(A) 165 (B) 64 (C) 75  
(D) -65 (E) NONE OF THESE  
E

23  
X 2  
---

(A) 46 (B) 49 (C) 26  
(D) 423 (E) NONE OF THESE  
A

125  
X 2  
-----

(A) 245 (B) 250 (C) 260  
(D) 127 (E) NONE OF THESE  
B

321

X 5

-----

(A) 326            (B) 1,505            (C) 1,605  
 (D) 1,355        (E) NONE OF THESE

C

111

X 6

-----

(A) 117            (B) 667            (C) 616  
 (D) 666            (E) NONE OF THESE

D

323

X 3

-----

(A) 929            (B) 369            (C) 963  
 (D) 326            (E) NONE OF THESE

E

325

X 30

-----

(A) 9,750            (B) 9,650            (C) 975  
 (D) 355            (E) NONE OF THESE

A

423

X 52

-----

(A) 20,746            (B) 21,996            (C) 455  
 (D) 476            (E) NONE OF THESE

B

503

X 14

-----

(A) 2,012            (B) 5,112            (C) 7,042  
 (D) 517            (E) NONE OF THESE

C

326

X 73

-----

(A) 21,698            (B) 978            (C) 2,282  
 (D) 23,798            (E) NONE OF THESE

D

6035

X 7

-----

(A) 42,035            (B) 42,025            (C) 60,335  
 (D) 6,042            (E) NONE OF THESE

E

3021

X 45

-----

- (A) 135,945      (B) 14,445      (C) 3,085  
 (D) 125,985      (E) NONE OF THESE

A

 $(-8) \times (7) =$ 

- (A) 56  
 (B) -56  
 (C) -560  
 (D) 15      (E) NONE OF THESE

B

 $(23) \times (-13) =$ 

- (A) 299  
 (B) -49  
 (C) -299  
 (D) 2,319      (E) NONE OF THESE

C

4327

X 11

-----

- (A) 4,327      (B) 44,397      (C) 4,338  
 (D) 47,597      (E) NONE OF THESE

D

 $(-18) \times (-5) =$ 

- (A) -90  
 (B) 80  
 (C) 23  
 (D) -23      (E) NONE OF THESE

E

-----

5)35

- (A) 7  
 (B) 6  
 (C) 5  
 (D) 8  
 (E) NONE OF THESE

A

-----

3)33

- (A) 10  
 (B) 11  
 (C) 12  
 (D) 13  
 (E) NONE OF THESE

B

-----

10)100

- (A) 9  
 (B) 11  
 (C) 10  
 (D) 8  
 (E) NONE OF THESE

C

-----  
4)28 (A) 6  
(B) 12  
(C) 70  
(D) 7  
(E) NONE OF THESE

D

-----  
8)56 (A) 4  
(B) 6  
(C) 8  
(D) 9  
(E) NONE OF THESE

E

-----  
12)144 (A) 12  
(B) 120  
(C) 11  
(D) 14  
(E) NONE OF THESE

A

-----  
6)126 (A) 121  
(B) 21  
(C) 22  
(D) 101  
(E) NONE OF THESE

B

-----  
50)2500 (A) 55  
(B) 5  
(C) 50  
(D) 70  
(E) NONE OF THESE

C

-----  
44)1452 (A) 30  
(B) 40  
(C) 43  
(D) 33  
(E) NONE OF THESE

D

-----  
6)636 (A) 16  
(B) 104  
(C) 166  
(D) 100  
(E) NONE OF THESE

E

-----  
86)2924 (A) 34  
(B) 33  
(C) 340  
(D) 44  
(E) NONE OF THESE

A

-----  
500)2500  
(A) 50  
(B) 5  
(C) 500  
(D) 25  
(E) NONE OF THESE

B

-----  
63)4851  
(A) 67  
(B) 75  
(C) 77  
(D) 76  
(E) NONE OF THESE

C

-----  
65)8125  
(A) 117  
(B) 155  
(C) 134  
(D) 125  
(E) NONE OF THESE

D

-----  
24)2112  
(A) 80  
(B) 98  
(C) 78  
(D) 880  
(E) NONE OF THESE

E

2.5  
+1.4  
-----  
(A) 3.9  
(B) 4.6  
(C) 5.1  
(D) 3.7  
(E) NONE OF THESE

A

3  
+ .04  
1.1  
-----  
(A) 3.04  
(B) 4.14  
(C) 1.44  
(D) 3.114"  
(E) NONE OF THESE

B

55  
+ 3.1  
-----  
(A) 85.1  
(B) 52.1  
(C) 58.1  
(D) 48.1  
(E) NONE OF THESE

C

3.1  
.77  
+22.6  
-----  
(A) 54.47  
(B) 33.4  
(C) 3.34  
(D) 26.47  
(E) NONE OF THESE

D

4.43            (A) 66.19  
   .189        (B) 761.9  
 +3            (C) 7.19  
 -----      (D) 76.19  
               (E) NONE OF THESE

E

.07+6.4+3.38= (A) 9.85  
                   (B) 1.048  
                   (C) 4.09  
                   (D) 10.48  
                   (E) NONE OF THESE

A

7yd. 1ft. 1in.    (A) 4 yd. 6ft.  
 +3yd. 1ft. 3in.   (B) 10yd. 2ft. 4in.  
 -----            (C) 10yd. 3ft.  
                       (D) 10yd. 1ft. 4in.  
                       (E) NONE OF THESE

B

\$56.35            (A) \$96.03  
 + 4.78            (B) \$103.15  
 -----            (C) \$61.13  
                       (D) \$51.13  
                       (E) NONE OF THESE

C

6+4.7+.0186=    (A) 10.6186  
                       (B) 1.0886  
                       (C) 9.6086  
                       (D) 10.7186  
                       (E) NONE OF THESE

D

\$65.78            (A) \$22.56  
 + 43.21           (B) \$108.77  
 -----            (C) \$107.88  
                       (D) \$109.00  
                       (E) NONE OF THESE

E

\$86.24            (A) \$113.38  
   6.13            (B) \$124.47  
  11.76            (C) \$123.39  
 + 9.25            (D) \$103.38  
 -----            (E) NONE OF THESE

A

6yd. 2ft. 8in.    (A) 11yd. 8ft. 16in.  
 +5yd. 6ft. 8in.   (B) 14yd. 4in.  
 -----            (C) 13yd. 3ft. 12in.  
                       (D) 14yd. 16in.  
                       (E) NONE OF THESE

B

$$.0176 + 6 + 1.87 =$$

- (A) .8046  
 (B) 2.4876  
 (C) 7.8876  
 (D) 6.7876  
 (E) NONE OF THESE

C

$$43.61 + 1.1 + 8 + .347 =$$

- (A) 471.71  
 (B) 53.37  
 (C) 52.046  
 (D) 53.057  
 (E) NONE OF THESE

D

$$\begin{array}{r} 9\text{yd. } 2\text{ft. } 7\text{in.} \\ + 4\text{yd. } 3\text{ft. } 6\text{in.} \\ \hline \end{array}$$

- (A) 13yd. 6ft. 13in.  
 (B) 13yd. 7ft. 1in.  
 (C) 15yd. 13in.  
 (D) 15yd. 1ft. 1in.  
 (E) NONE OF THESE

E

$$\begin{array}{r} 9.8 \\ - 7.1 \\ \hline \end{array}$$

- (A) 2.7  
 (B) 16.9  
 (C) 2.78  
 (D) 3.7  
 (E) NONE OF THESE

A

$$\begin{array}{r} \$1.50 \\ - .25 \\ \hline \end{array}$$

- (A) \$-1.25  
 (B) \$1.25  
 (C) \$1.75  
 (D) \$-1.75  
 (E) NONE OF THESE

B

$$6.8 - 3.2 =$$

- (A) 10  
 (B) 9.0  
 (C) 3.6  
 (D) -3.6  
 (E) NONE OF THESE

C

$$\begin{array}{r} \$5.56 \\ - 1.11 \\ \hline \end{array}$$

- (A) \$6.66  
 (B) \$4.67  
 (C) \$6.77  
 (D) \$4.45  
 (E) NONE OF THESE

D

$$9.8 - 3 =$$

- (A) 12.8  
 (B) 10.1  
 (C) 9.11  
 (D) 6.11  
 (E) NONE OF THESE

E



\$47.89  
- 29.98  
-----

- (A) \$17.91  
(B) \$77.87  
(C) \$28.91  
(D) \$27.91  
(E) NONE OF THESE

A

\$156.87  
- 98.98  
-----

- (A) \$47.89  
(B) \$57.89  
(C) \$67.98  
(D) \$56.89  
(E) NONE OF THESE

B

87.09-.987=

- (A) 76.103  
(B) 87.997  
(C) 86.103  
(D) 87.103  
(E) NONE OF THESE

C

\$156.95-\$13.76=

- (A) \$170.71  
(B) \$14.39  
(C) \$3.19  
(D) \$143.19  
(E) NONE OF THESE

D

3DYS. 2HRS. 45MIN.  
-1DY. 1HR. 15MIN.  
-----

- (A) 4DYS. 3HRS.  
(B) 2DYS. 1HR. 40MIN.  
(C) 2DYS. 4HRS. 60MIN.  
(D) 1DY. 1HR. 30MIN.  
(E) NONE OF THESE

E

\$998.76  
- 764.97  
-----

- (A) \$233.79  
(B) \$234.79  
(C) \$234.89  
(D) \$244.99  
(E) NONE OF THESE

A

\$176.98-59.98=

- (A) \$120.89  
(B) \$120.00  
(C) \$236.90  
(D) \$236.00  
(E) NONE OF THESE

B

8DYS. 5HRS. 50MIN. (A) 3DYS. 11HRS. 120MIN.  
-5DYS. 6HRS. 60MIN. (B) 3DYS. 9HRS. 10MIN.  
----- (C) 2DYS. 22HRS. 50MIN.

- (D) 3DYS. 22MIN. 50MIN.  
(E) NONE OF THESE

C

87.31-.9876= (A) 87.9876  
 (B) 87.6776  
 (C) 86.38  
 (D) 86.3224  
 (E) NONE OF THESE

D

165.4-73.865= (A) 65.565  
 (B) 239.26  
 (C) 76.535  
 (D) 85.635  
 (E) NONE OF THESE

E

3.2 (A) 3.84  
 X1.2 (B) 4.4  
 ---- (C) 2.0  
 (D) 2.44  
 (E) NONE OF THESE

A

1.5 (A) 1.35  
 X .7 (B) 1.05  
 ---- (C) 2.2  
 (D) 105  
 (E) NONE OF THESE

B

6.7 (A) 8.8  
 X2.1 (B) 12.8  
 ---- (C) 14.07  
 (D) 4.5  
 (E) NONE OF THESE

C

3.9 (A) 5.16  
 X2.7 (B) 1.2  
 ----- (C) 6.6  
 (D) 10.53  
 (E) NONE OF THESE

D

386.4 (A) 7.728  
 X 2 (B) 386.6  
 ----- (C) 77.28  
 (D) 386.2  
 (E) NONE OF THESE

E

1YD. 1FT. (A) 4YD.  
 X 3 (B) 1YD. 4FT.  
 ----- (C) 3YD. 4FT.  
 (D) 3YD. 1FT.  
 (E) NONE OF THESE

A

486.7  
X 2.3  
-----  
(A) 11.94  
(B) 1119.41  
(C) 119  
(D) 1.1941  
(E) NONE OF THESE

B

3.6  
X7.9  
-----  
(A) 11.5  
(B) 11.15  
(C) 28.44  
(D) 2.84  
(E) NONE OF THESE

C

33.6  
X 2.1  
-----  
(A) 35.7  
(B) 35.5  
(C) 31.5  
(D) 70.56  
(E) NONE OF THESE

D

467.4  
X 3  
-----  
(A) 1.4022  
(B) 467.12  
(C) 467.7  
(D) 140.22  
(E) NONE OF THESE

E

36.3  
X.014  
-----  
(A) .5082  
(B) .377  
(C) 35.9  
(D) 37.7  
(E) NONE OF THESE

A

796.3  
X 24.6  
-----  
(A) 820.9  
(B) 19,588.98  
(C) 771.7  
(D) 19.587  
(E) NONE OF THESE

B

5YD. 4FT.  
X 3FT.  
-----  
(A) 15YDS. 11FT.  
(B) 5YDS. 7FT.  
(C) 19YDS.  
(D) 5YDS. 1FT.  
(E) NONE OF THESE

C

24.6  
X.019  
-----  
(A) 26.5  
(B) .255  
(C) .227  
(D) .4674  
(E) NONE OF THESE

D

$$\begin{array}{r} 88.74 \\ \times 3.91 \\ \hline \end{array}$$
  
 (A) 3.46  
 (B) 347  
 (C) 346.9543  
 (D) 34.69  
 (E) NONE OF THESE

E

$$\begin{array}{r} \text{----} \\ 2)6.4 \end{array}$$
  
 (A) 3.2  
 (B) 3.0  
 (C) 6.8  
 (D) 6.2  
 (E) NONE OF THESE

A

$$\begin{array}{r} \text{-----} \\ 5)25.5 \end{array}$$
  
 (A) 25.1  
 (B) 5.1  
 (C) 30.0  
 (D) 51  
 (E) NONE OF THESE

B

$$\begin{array}{r} \text{-----} \\ 3)9.69 \end{array}$$
  
 (A) 9.72  
 (B) 9.99  
 (C) 3.23  
 (D) 9.66  
 (E) NONE OF THESE

C

$$\begin{array}{r} \text{-----} \\ 25)50.50 \end{array}$$
  
 (A) 50.25  
 (B) 25.50  
 (C) 50.75  
 (D) 2.02  
 (E) NONE OF THESE

D

$$\begin{array}{r} \text{----} \\ 3)8.4 \end{array}$$
  
 (A) 2.78  
 (B) 8.7  
 (C) 7.9  
 (D) 2.6  
 (E) NONE OF THESE

E

$$\begin{array}{r} \text{----} \\ 4.2)8.4 \end{array}$$
  
 (A) 2  
 (B) 12.6  
 (C) 4.6  
 (D) .2  
 (E) NONE OF THESE

A

$$\begin{array}{r} \text{----} \\ .03)9 \end{array}$$
  
 (A) 9.03  
 (B) 300  
 (C) 6  
 (D) 93  
 (E) NONE OF THESE

B

-----  
6.6)396 (A) 6.6  
(B) 39.66  
(C) 60  
(D) 33.6  
(E) NONE OF THESE

C

-----  
.3)6.69 (A) 9.69  
(B) 67.2  
(C) 6.99  
(D) 22.3  
(E) NONE OF THESE

D

-----  
.5)4.5 (A) 5  
(B) 4.0  
(C) 9.5  
(D) .4  
(E) NONE OF THESE

E

-----  
32.3)19.38 (A) .6  
(B) 51.68  
(C) 60  
(D) 6.6  
(E) NONE OF THESE

A

-----  
5.30)39.22 (A) 44.52  
(B) 7.4  
(C) 34.52  
(D) 28.92  
(E) NONE OF THESE

B

-----  
.46)3.772 (A) 8  
(B) 49.772  
(C) 8.2  
(D) 3.232  
(E) NONE OF THESE

C

-----  
50)578.5 (A) 11.5  
(B) 528.5  
(C) 628.5  
(D) 11.57  
(E) NONE OF THESE

D

-----  
.08)2.66 (A) 10.66  
(B) 2.0866  
(C) 2.74  
(D) 33  
(E) NONE OF THESE

E

$$\begin{array}{r} 1/2 \\ +1/2 \\ \hline \end{array}$$

(A) 1  
(B)  $1/2$   
(C)  $1/4$   
(D)  $2/8$   
(E) NONE OF THESE

A

$$\begin{array}{r} 1/3 \\ +1/3 \\ \hline \end{array}$$

(A)  $1/3$   
(B)  $2/3$   
(C) 13  
(D) 31  
(E) NONE OF THESE

B

$$\begin{array}{r} 3 \frac{1}{4} \\ +2 \frac{1}{2} \\ \hline \end{array}$$

(A)  $1 \frac{3}{4}$   
(B)  $5 \frac{2}{6}$   
(C)  $5 \frac{3}{4}$   
(D)  $5 \frac{1}{2}$   
(E) NONE OF THESE

C

$$\begin{array}{r} 1/5 \\ +2/3 \\ \hline \end{array}$$

(A)  $3/8$   
(B) 2  
(C)  $3/4$   
(D)  $13/15$   
(E) NONE OF THESE

D

$$\begin{array}{r} 1/4 \\ +3/8 \\ \hline \end{array}$$

(A)  $3/4$   
(B)  $7/8$   
(C)  $1/8$   
(D)  $5/7$   
(E) NONE OF THESE

E

$$\begin{array}{r} 10 \frac{2}{3} \\ + 5 \frac{5}{6} \\ \hline \end{array}$$

(A)  $16 \frac{1}{2}$   
(B)  $15 \frac{7}{9}$   
(C)  $5 \frac{1}{2}$   
(D)  $5 \frac{7}{9}$   
(E) NONE OF THESE

A

$$\begin{array}{r} 6 \frac{3}{4} \\ + \frac{7}{8} \\ \hline \end{array}$$

(A)  $6 \frac{10}{11}$   
(B)  $7 \frac{5}{8}$   
(C)  $6 \frac{5}{6}$   
(D)  $6 \frac{21}{32}$   
(E) NONE OF THESE

B

$$\begin{array}{r} 3/8 \\ +7/40 \\ \hline \end{array}$$

(A)  $10/48$   
(B)  $5/24$   
(C)  $11/20$   
(D)  $21/48$   
(E) NONE OF THESE

C

$1 \frac{3}{4}$   
 $+6 \frac{5}{7}$   
 -----  
 (A)  $7 \frac{10}{11}$   
 (B)  $6 \frac{8}{11}$   
 (C)  $5 \frac{2}{3}$   
 (D)  $8 \frac{13}{28}$   
 (E) NONE OF THESE

D

$\frac{3}{4}$   
 $+2 \frac{2}{3}$   
 -----  
 (A)  $\frac{5}{7}$   
 (B)  $\frac{1}{7}$   
 (C)  $\frac{1}{2}$   
 (D) 2  
 (E) NONE OF THESE

E

$22 \frac{7}{8}$   
 $+3 \frac{6}{7}$   
 -----  
 (A)  $26 \frac{41}{56}$   
 (B)  $25 \frac{13}{15}$   
 (C)  $19 \frac{1}{7}$   
 (D)  $66 \frac{13}{15}$   
 (E) NONE OF THESE

A

$9 \frac{7}{9}$   
 $+11 \frac{3}{8}$   
 -----  
 (A)  $10 \frac{10}{17}$   
 (B)  $21 \frac{11}{72}$   
 (C)  $-2 \frac{4}{9}$   
 (D)  $-2 \frac{1}{2}$   
 (E) NONE OF THESE

B

$24 \frac{5}{6}$   
 $+26 \frac{3}{9}$   
 -----  
 (A)  $-2 \frac{2}{3}$   
 (B)  $50 \frac{8}{15}$   
 (C)  $51 \frac{1}{6}$   
 (D)  $50 \frac{2}{3}$   
 (E) NONE OF THESE

C

$93 \frac{10}{11}$   
 $+7 \frac{2}{3}$   
 -----  
 (A)  $86 \frac{20}{33}$   
 (B) 86  
 (C)  $100 \frac{6}{7}$   
 (D)  $101 \frac{19}{33}$   
 (E) NONE OF THESE

D

$31 \frac{21}{23}$   
 $+37 \frac{5}{6}$   
 -----  
 (A)  $6 \frac{16}{17}$   
 (B)  $68 \frac{26}{29}$   
 (C)  $-6 \frac{6}{17}$   
 (D)  $68 \frac{103}{138}$   
 (E) NONE OF THESE

E

$\frac{2}{5}$   
 $-\frac{1}{5}$   
 -----  
 (A)  $\frac{1}{5}$   
 (B)  $\frac{3}{5}$   
 (C)  $\frac{2}{25}$   
 (D)  $\frac{3}{10}$   
 (E) NONE OF THESE

A

$\frac{3}{4}$   
 $-\frac{1}{2}$   
 ----  
 (A)  $-\frac{1}{2}$   
 (B)  $\frac{1}{4}$   
 (C)  $\frac{2}{3}$   
 (D) 1  
 (E) NONE OF THESE

B

$7\frac{3}{8}$   
 $-5\frac{1}{8}$   
 -----  
 (A)  $12\frac{1}{2}$   
 (B)  $1\frac{1}{4}$   
 (C)  $2\frac{1}{4}$   
 (D)  $2\frac{3}{8}$   
 (E) NONE OF THESE

C

$\frac{1}{2}$   
 $-\frac{1}{4}$   
 ----  
 (A)  $\frac{3}{8}$   
 (B)  $\frac{1}{2}$   
 (C)  $\frac{1}{3}$   
 (D)  $\frac{1}{4}$   
 (E) NONE OF THESE

D

$6\frac{5}{8}$   
 $-1\frac{3}{8}$   
 -----  
 (A)  $6\frac{1}{4}$   
 (B)  $1\frac{3}{8}$   
 (C)  $5\frac{1}{8}$   
 (D) 9  
 (E) NONE OF THESE

E

$8\frac{2}{5}$   
 $-3$   
 -----  
 (A)  $5\frac{2}{5}$   
 (B)  $4\frac{2}{5}$   
 (C)  $11\frac{2}{5}$   
 (D) 17  
 (E) NONE OF THESE

A

$9\frac{6}{7}$   
 $-8\frac{3}{4}$   
 -----  
 (A) 2  
 (B)  $1\frac{3}{28}$   
 (C)  $1\frac{9}{11}$   
 (D)  $-8\frac{3}{4}$   
 (E) NONE OF THESE

B

$21\frac{1}{5}$   
 $-6\frac{3}{5}$   
 -----  
 (A)  $27\frac{4}{5}$   
 (B)  $15\frac{2}{5}$   
 (C)  $14\frac{3}{5}$   
 (D)  $15\frac{2}{3}$   
 (E) NONE OF THESE

C

$\frac{3}{5}$   
 $-\frac{1}{3}$   
 ----  
 (A)  $\frac{2}{3}$   
 (B)  $\frac{1}{2}$   
 (C)  $\frac{2}{5}$   
 (D)  $\frac{4}{15}$   
 (E) NONE OF THESE

D



$$\begin{array}{r} 8 \frac{1}{4} \\ - 2 \frac{3}{4} \\ \hline \end{array}$$

(A)  $6 \frac{1}{2}$   
 (B) 7  
 (C)  $6 \frac{3}{4}$   
 (D)  $5 \frac{1}{4}$   
 (E) NONE OF THESE

E

$$\begin{array}{r} 19 \frac{1}{7} \\ - 3 \frac{3}{4} \\ \hline \end{array}$$

(A)  $15 \frac{9}{28}$   
 (B)  $16 \frac{1}{2}$   
 (C)  $22 \frac{4}{11}$   
 (D)  $-3 \frac{3}{4}$   
 (E) NONE OF THESE

A

$$\begin{array}{r} 31 \frac{1}{4} \\ - 8 \frac{3}{4} \\ \hline \end{array}$$

(A)  $23 \frac{1}{2}$   
 (B)  $22 \frac{1}{2}$   
 (C) 40  
 (D)  $-8 \frac{3}{4}$   
 (E) NONE OF THESE

B

$$\begin{array}{r} 18 \frac{3}{5} \\ - 7 \frac{9}{11} \\ \hline \end{array}$$

(A)  $25 \frac{12}{13}$   
 (B)  $-7 \frac{9}{8}$   
 (C)  $10 \frac{43}{55}$   
 (D)  $10 \frac{19}{40}$   
 (E) NONE OF THESE

C

$$\begin{array}{r} 43 \frac{3}{7} \\ - 19 \frac{6}{8} \\ \hline \end{array}$$

(A)  $62 \frac{9}{15}$   
 (B)  $-19 \frac{3}{4}$   
 (C)  $34 \frac{9}{15}$   
 (D)  $23 \frac{19}{28}$   
 (E) NONE OF THESE

D

$$\begin{array}{r} 21 \frac{1}{4} \\ - 8 \frac{3}{5} \\ \hline \end{array}$$

(A)  $29 \frac{4}{9}$   
 (B)  $-8 \frac{3}{5}$   
 (C)  $12 \frac{3}{5}$   
 (D)  $13 \frac{3}{4}$   
 (E) NONE OF THESE

E

$$\frac{1}{2} \times \frac{1}{2} =$$

(A)  $\frac{1}{4}$   
 (B) 1  
 (C)  $\frac{1}{2}$   
 (D)  $\frac{2}{5}$   
 (E) NONE OF THESE

A

$$\frac{1}{3} \times \frac{1}{3} =$$

(A)  $\frac{1}{3}$   
 (B)  $\frac{1}{9}$   
 (C) 3  
 (D) 1  
 (E) NONE OF THESE

B

- $\frac{3}{4} \times \frac{1}{2} =$  (A)  $\frac{1}{3}$   
(B)  $1\frac{1}{2}$   
(C)  $\frac{3}{8}$   
(D)  $2\frac{1}{4}$   
(E) NONE OF THESE

C

- $2 \times \frac{1}{8} =$  (A)  $2\frac{1}{8}$   
(B)  $\frac{1}{8}$   
(C) 4  
(D)  $\frac{1}{4}$   
(E) NONE OF THESE

D

- $\frac{1}{5} \times \frac{3}{5} =$  (A)  $\frac{3}{10}$   
(B)  $\frac{2}{5}$   
(C)  $\frac{4}{5}$   
(D)  $\frac{1}{5}$   
(E) NONE OF THESE

E

- $\frac{3}{4} \times \frac{6}{7} =$  (A)  $\frac{9}{14}$   
(B)  $\frac{9}{11}$   
(C) 1  
(D)  $\frac{3}{7}$   
(E) NONE OF THESE

A

- $2\frac{4}{5} \times \frac{2}{3} =$  (A)  $2\frac{3}{4}$   
(B)  $1\frac{13}{15}$   
(C)  $2\frac{1}{2}$   
(D)  $1\frac{5}{8}$   
(E) NONE OF THESE

B

- $\frac{3}{5} \times 2\frac{1}{6} =$  (A)  $2\frac{1}{10}$   
(B)  $2\frac{4}{11}$   
(C)  $1\frac{3}{10}$   
(D)  $1\frac{1}{10}$   
(E) NONE OF THESE

C

- $7\frac{1}{4} \times \frac{1}{7} =$  (A) 7  
(B)  $7\frac{1}{28}$   
(C)  $7\frac{2}{11}$   
(D)  $1\frac{1}{28}$   
(E) NONE OF THESE

D

- $\frac{1}{4} \times 4 =$  (A)  $4\frac{1}{4}$   
(B)  $\frac{1}{4}$   
(C)  $3\frac{3}{4}$   
(D) 2  
(E) NONE OF THESE

E

- $7 \frac{3}{4} \times 2 \frac{1}{6} =$  (A)  $16 \frac{19}{24}$   
 (B)  $9 \frac{3}{10}$   
 (C)  $14 \frac{1}{8}$   
 (D)  $5 \frac{1}{2}$   
 (E) NONE OF THESE

A

- $8 \frac{2}{3} \times 2 \frac{1}{5} =$  (A)  $16 \frac{2}{15}$   
 (B)  $19 \frac{1}{15}$   
 (C)  $6 \frac{1}{5}$   
 (D)  $10 \frac{3}{8}$   
 (E) NONE OF THESE

B

- $4 \frac{1}{4} \times 3 \frac{1}{3} =$  (A)  $7 \frac{2}{7}$   
 (B)  $12 \frac{1}{12}$   
 (C)  $14 \frac{1}{6}$   
 (D)  $1 \frac{1}{3}$   
 (E) NONE OF THESE

C

- $6 \frac{1}{2} \times 5 \frac{1}{4} =$  (A)  $1 \frac{1}{4}$   
 (B)  $11 \frac{1}{4}$   
 (C)  $30 \frac{1}{8}$   
 (D)  $34 \frac{1}{8}$   
 (E) NONE OF THESE

D

- $8 \frac{1}{9} \times 3 \frac{1}{4} =$  (A)  $5 \frac{1}{5}$   
 (B)  $11 \frac{2}{13}$   
 (C)  $24 \frac{1}{36}$   
 (D) 27  
 (E) NONE OF THESE

E

- $\frac{1}{2} - \frac{1}{2} =$  (A) 1  
 (B)  $\frac{1}{4}$   
 (C)  $\frac{1}{2}$   
 (D)  $\frac{2}{5}$   
 (E) NONE OF THESE

A

- $\frac{3}{4} - \frac{1}{4} =$  (A)  $\frac{1}{2}$   
 (B) 3  
 (C) 2  
 (D) 4  
 (E) NONE OF THESE

B

- $\frac{1}{8} - \frac{3}{8} =$  (A)  $\frac{1}{4}$   
 (B)  $\frac{2}{5}$   
 (C)  $\frac{1}{3}$   
 (D)  $\frac{3}{16}$   
 (E) NONE OF THESE

C

- $\frac{1}{5} - \frac{3}{5} =$   
 .  
 (A)  $\frac{1}{2}$   
 (B)  $\frac{2}{5}$   
 (C)  $\frac{3}{10}$   
 (D)  $\frac{1}{3}$   
 (E) NONE OF THESE

D

- $\frac{4}{7} - \frac{1}{7} =$   
 .  
 (A) 1  
 (B) 7  
 (C)  $\frac{3}{7}$   
 (D)  $\frac{4}{49}$   
 (E) NONE OF THESE

E

- $5 - \frac{1}{3} =$   
 .  
 (A) 15  
 (B)  $5 \frac{1}{3}$   
 (C)  $1 \frac{2}{3}$   
 (D)  $4 \frac{2}{3}$   
 (E) NONE OF THESE

A

- $7 - \frac{1}{2} =$   
 .  
 (A)  $6 \frac{1}{2}$   
 (B) 14  
 (C)  $7 \frac{1}{2}$   
 (D)  $3 \frac{1}{2}$   
 (E) NONE OF THESE

B

- $3 - \frac{1}{2} =$   
 .  
 (A)  $3 \frac{1}{2}$   
 (B)  $1 \frac{1}{2}$   
 (C) 6  
 (D)  $2 \frac{1}{2}$   
 (E) NONE OF THESE

C

- $8 - \frac{1}{4} =$   
 .  
 (A)  $7 \frac{3}{4}$   
 (B)  $8 \frac{1}{4}$   
 (C) 2  
 (D) 32  
 (E) NONE OF THESE

D

- $9 - \frac{1}{6} =$   
 .  
 (A)  $8 \frac{5}{5}$   
 (B)  $9 \frac{1}{6}$   
 (C)  $1 \frac{1}{2}$   
 (D) 56  
 (E) NONE OF THESE

E

- $5 \frac{1}{4} - 2 \frac{1}{2} =$   
 .  
 (A)  $2 \frac{1}{10}$   
 (B)  $7 \frac{1}{3}$   
 (C)  $3 \frac{1}{4}$   
 (D) 3  
 (E) NONE OF THESE

A

- $6 \frac{1}{5} - 2 \frac{1}{3} =$   
 (A)  $3 \frac{3}{5}$   
 (B)  $2 \frac{23}{35}$   
 (C)  $4 \frac{1}{2}$   
 (D)  $8 \frac{1}{8}$   
 (E) NONE OF THESE

B

- $7 \frac{1}{4} - 3 \frac{1}{6} =$   
 (A)  $10 \frac{1}{5}$   
 (B)  $4 \frac{1}{2}$   
 (C)  $2 \frac{11}{38}$   
 (D)  $4 \frac{1}{4}$   
 (E) NONE OF THESE

C

- $9 \frac{1}{4} - 3 \frac{2}{3} =$   
 (A)  $6 \frac{1}{9}$   
 (B)  $7 \frac{4}{11}$   
 (C)  $5 \frac{3}{8}$   
 (D)  $2 \frac{13}{44}$   
 (E) NONE OF THESE

D

- $7 \frac{1}{5} - 2 \frac{2}{3} =$   
 (A)  $1 \frac{7}{10}$   
 (B)  $9 \frac{3}{8}$   
 (C)  $5 \frac{1}{2}$   
 (D) 2  
 (E) NONE OF THESE

E

- IF  $X+6=13$ , THEN  $X=$   
 (A) 7  
 (B) 6  
 (C) 5  
 (D) 19  
 (E) NONE OF THESE

A

- IF  $3X=18$ , THEN  $X=$   
 (A) 54  
 (B) 6  
 (C) 21  
 (D) 15  
 (E) NONE OF THESE

B

- $(3+1)X(8-4)=$   
 (A) 24  
 (B) 48  
 (C) 16  
 (D) 0  
 (E) NONE OF THESE

C

- WHICH OF THE  
 FOLLOWING NUMBERS  
 HAS THE GREATER  
 VALUE?  
 (A) 70  
 (B)  $61 \frac{1}{2}$   
 (C)  $73 \frac{4}{5}$   
 (D) 75  
 (E) NONE OF THESE

D

THE ROMAN NUMERAL  
XV MEANS

(A) 55  
(B) 11  
(C) 21  
(D) 105  
(E) NONE OF THESE

E

$\frac{3}{3} =$

(A) 27  
(B) 6  
(C) 0  
(D) 9  
(E) NONE OF THESE

A

IF  $X/5 = 5$ , THEN  $X =$

(A) 10  
(B) 25  
(C) 15  
(D) 1  
(E) NONE OF THESE

B

IF  $S=4$  AND  $T=3$ , FIND  
THE VALUE OF  $X$  WHICH  
MAKES THE FOLLOWING  
EQUATION TRUE.  
 $X=10+S-T$

(A) 12  
(B) 3  
(C) 11  
(D) 10  
(E) NONE OF THESE

C

IF  $S=7$  AND  $T=5$ , FIND  
THE VALUE OF  $X$  WHICH  
MAKES THE FOLLOWING  
EQUATION TRUE.  
 $X=10-S+T$

(A) 12  
(B) -2  
(C) 22  
(D) 8  
(E) NONE OF THESE

D

$5.03 \times 5^2 =$

(A) 12.57  
(B) 5.53  
(C) 5.28  
(D) .03  
(E) NONE OF THESE

E

ASSUME  $A*B$  MEANS  
 $A-B+4$ . WHAT IS  
 $6*3$ ?

(A) 7  
(B) 9  
(C) 3  
(D) 13  
(E) NONE OF THESE

A

IF  $X/4=2/3$ , THEN  $X =$

(A)  $1/6$   
(B)  $2\frac{2}{3}$   
(C)  $4\frac{2}{3}$   
(D) 32  
(E) NONE OF THESE

B

- IF  $X/3=1/2$ , THEN  $X=$
- (A)  $1/6$
  - (B)  $1/5$
  - (C)  $1\ 1/2$
  - (D) 6
  - (E) NONE OF THESE

C

- ASSUME  $A*B$  MEANS  
 $A+B+4$ . WHAT IS  
 $8*2$ ?
- (A) 2
  - (B) 6
  - (C) 16
  - (D) 14
  - (E) NONE OF THESE

D

- IF  $X/6=1/2$ , THEN  $X=$
- (A) 1
  - (B) 2
  - (C) 4
  - (D) 12
  - (E) NONE OF THESE

E

- THE SYMBOL  $+$  MEANS
- (A) ADD
  - (B) MINUS
  - (C) DIVIDE
  - (D) PERCENT
  - (E) NONE OF THESE

A

- THE SYMBOL  $=$  MEANS
- (A) GREATER THAN
  - (B) EQUALS
  - (C) SQUARE ROOT
  - (D) OUNCE
  - (E) NONE OF THESE

B

- THE SYMBOL  $\cdot$  MEANS
- (A) ADD
  - (B) MINUS
  - (C) DIVIDED BY
  - (D) MULTIPLY
  - (E) NONE OF THESE

C

- THE SYMBOL  $\times$  MEANS
- (A) RADIUS
  - (B) ADD
  - (C) SUBTRACT
  - (D) MULTIPLY
  - (E) NONE OF THESE

D

- THE SYMBOL  $-$  MEANS
- (A) SQUARE ROOT
  - (B) PERCENT
  - (C) LESS THAN
  - (D) GREATER THAN
  - (E) NONE OF THESE

E

- THE SYMBOL  $\%$  MEANS
- (A) PERCENT
  - (B) EQUAL TO
  - (C) ADD
  - (D) MINUS
  - (E) NONE OF THESE
- A
- THE SYMBOL  $<$  MEANS
- (A) IS EQUAL TO
  - (B) IS LESS THAN
  - (C) IS GREATER THAN
  - (D) PI
  - (E) NONE OF THESE
- B
- THE SYMBOL  $-$  MEANS
- (A) PERCENT
  - (B) ADD
  - (C) MINUS
  - (D) SQUARE ROOT
  - (E) NONE OF THESE
- C
- THE SYMBOL  $>$  MEANS
- (A) PI
  - (B) RADIUS
  - (C) IS LESS THAN
  - (D) IS GREATER THAN
  - (E) NONE OF THESE
- D
- THE SYMBOL  $\circ$  MEANS
- (A) PERCENT
  - (B) PI
  - (C) RADIUS
  - (D) OUNCE
  - (E) NONE OF THESE
- E
- THE SYMBOL  $\sqrt{\quad}$  MEANS
- (A) SQUARE ROOT
  - (B) PI
  - (C) UNION OF
  - (D) EMPTY SET
  - (E) NONE OF THESE
- A
- THE SYMBOL  $\cup$  MEANS
- (A) INTERSECTION
  - (B) UNION
  - (C) SUBSET OF
  - (D) MULTIPLY
  - (E) NONE OF THESE
- B
- THE SYMBOL  $(\quad)$  MEANS
- (A) CIRCLE
  - (B) DEGREE
  - (C) PARENTHESES
  - (D) BRACKETS
  - (E) NONE OF THESE
- C



THE SYMBOL \* MEANS (A) DRAM  
(B) OUNCE  
(C) POUND  
(D) MULTIPLY  
(E) NONE OF THESE

D

THE SYMBOL = MEANS (A) AN EMPTY SET  
(B) NOT A UNION OF  
(C) PI  
(D) ADD  
(E) NONE OF THESE

E

HOW MANY MINUTES ARE (A) 75  
EQUAL TO 1 HOUR AND (B) 45  
15 MINUTES? (C) 70  
(D) 65  
(E) NONE OF THESE

A

HOW MANY INCHES ARE (A)  $12 \frac{1}{4}$   
EQUAL IN LENGTH TO (B) 15  
 $1 \frac{1}{4}$  FEET? (C) 16  
(D) 48  
(E) NONE OF THESE

B

HOW MANY DEGREES ARE (A) 45  
ARE THERE IN THE (B) 180  
MEASURE OF A RIGHT ANGLE? (C) 90  
(D) 60  
(E) NONE OF THESE

C

WHICH OF THE FOLLOWING (A) 3 GRAMS  
IS THE LIGHTEST WEIGHT? (B) 3 HECTOGRAMS  
(C) 3 KILOGRAMS  
(D) 3 MILLIGRAMS  
(E) NONE OF THESE

D

WHICH OF THE FOLLOWING (A) 1 LITER  
IS THE LONGEST MEASURE (B) 1 CENTIGRAM  
MEASURE OF LENGTH? (C) 1 KILOLITER  
(D) 1 HECTOGRAM  
(E) NONE OF THESE

E

WHICH TWO SIDES BELOW (A) AC, BD  
HAVE EQUAL MEASURE? (B) AB, AC  
A!-----!B (C) AC, CD  
! ! (D) BA, BD  
C!-----!D (E) NONE OF THESE

A

WHICH OF THE FOLLOWING RULES SHOULD BE USED TO FIND THE AREA OF A TRIANGLE?

(A)  $A=L*W$   
 (B)  $A=l/2BH$   
 (C)  $A=L+W$   
 (D)  $A=B*H$   
 (E) NONE OF THESE

B

HOW MANY DEGREES ARE THERE IN A CIRCLE?

(A) 180  
 (B) 60  
 (C) 360  
 (D) 90  
 (E) NONE OF THESE

C

HOW MANY MINUTES ARE EQUAL TO  $1\frac{1}{4}$  HOURS?

(A) 90  
 (B) 80  
 (C) 64  
 (D) 75  
 (E) NONE OF THESE

D

HOW MANY INCHES ARE EQUAL TO  $2\frac{1}{3}$  FEET?

(A) 24  
 (B) 25  
 (C) 26  
 (D) 27  
 (E) NONE OF THESE

E

WHICH OF THE FOLLOWING IS LIGHTEST WEIGHT?

(A) 3 MILLIGRAMS  
 (B) 3 HECTOGRAMS  
 (C) 3 GRAMS  
 (D) 3 KILOGRAMS  
 (E) NONE

A

WHAT IS THE AREA OF THE TRIANGLE BELOW? ( $A=l/2bh$ )

/!  
 / !7IN.  
 /10!

(A) 17 SQ.IN.  
 (B) 35 SQ.IN.  
 (C) 34 SQ.IN.  
 (D) 70 SQ.IN.  
 (E) NONE

B

WHAT IS THE AREA OF THE FIGURE BELOW IF ALL ANGLES ARE RIGHT ANGLES? !----3YD--!  
 ! !---1YD-!  
 3YD TALL !----4YD-----!1YD

(A) 9 SQ.YD.  
 (B) 3 SQ.YD.  
 (C) 10 SQ.YD.  
 (D) 8 SQ.YD.  
 (E) NONE

C

HOW MANY DEGREES ARE THERE IN A STRAIGHT ANGLE?

(A) 45  
 (B) 90  
 (C) 360  
 (D) 180  
 (E) NONE

D

WHAT IS THE AREA OF THE FIGURE  
BELOW IF ALL ANGLES ARE RIGHT  
ANGLES? !--2YD--!  
! !-1YD-!  
!--3YD-----!1YD

- (A) 6 SQ.YD.  
(B) 5 SQ.YD.  
(C) 8 SQ.YD.  
(D) 9 SQ.YD.  
(E) NONE

E

FORTY-SIX THOUSAND TWENTY-FIVE  
IS THE SAME AS

- (A) 46,025  
(B) 46,250  
(C) 4,250  
(D) 4,625  
(E) NONE

A

THREE TENTHS IS THE SAME AS

- (A) 310  
(B) .3  
(C) .03  
(D) .003  
(E) NONE

B

WHICH ONE OF THE FOLLOWING MEANS  
THE SAME AS THREE DOLLARS AND  
TEN CENTS?

- (A) 3.10  
(B) \$3.1  
(C) \$3.10  
(D) \$.31  
(E) NONE

C

3/10 MEANS THE SAME AS

- (A) 3  
(B) .33  
(C) .30  
(D) .3  
(E) NONE

D

WHICH ONE OF THE FOLLOWING MEANS  
THE SAME AS THIRTY DOLLARS AND  
SIXTY-NINE CENTS?

- (A) \$33.69  
(B) \$3.69  
(C) \$3.6  
(D) \$30.6  
(E) NONE

E

7/1,000 MEANS THE SAME AS

- (A) .007  
(B) 7,100  
(C) 7,000  
(D) .07  
(E) NONE

A

WHICH OF THE FOLLOWING NUMERALS  
HAS A 5 IN THE HUNDREDTH' PLACE?

- (A) 5.134  
(B) .157  
(C) .573  
(D) 500.3  
(E) NONE

B

WHICH OF THE FOLLOWING NUMBERS  
HAS THE GREATEST VALUE?

(A) .111  
(B) .011  
(C) .11  
(D) .999  
(E) NONE

C

ROUND .322 TO THE NEAREST  
HUNDREDTH.

(A) .3  
(B) .30  
(C) .33  
(D) .32  
(E) NONE

D

ROUND 37.18 TO THE NEAREST  
TENTH.

(A) .40  
(B) 36  
(C) 38.2  
(D) 7.28  
(E) NONE

E

WHICH OF THE FOLLOWING NUMBERS  
HAS THE GREATEST VALUE?

(A) .1  
(B) .001  
(C) .05  
(D) .999  
(E) NONE

A

ROUND .7103 TO THE NEAREST  
TENTH.

(A) .8  
(B) .7  
(C) .71  
(D) .710  
(E) NONE

B

ROUND 73.21 TO THE NEAREST  
TEN.

(A) 80  
(B) 90  
(C) 70  
(D) 73  
(E) NONE

C

51/100 MEANS THE SAME AS

(A) 5,100  
(B) .051  
(C) .15  
(D) .51  
(E) NONE

D

WHICH OF THE FOLLOWING NUMERALS  
HAS A 3 IN THE THOUSANDTHS'  
PLACE?

(A) .310  
(B) .034  
(C) 3,134.6  
(D) 304.15  
(E) NONE

E

WHAT IS THE GREATEST COMMON  
DIVISOR OF 4, 12, 20?

- (A) 4
- (B) 5
- (C) 6
- (D) 2
- (E) NONE

A

WHICH TWO NUMBERS CONTAIN TWO  
FACTORS OF TEN?

- (A) 1, 4
- (B) 2, 5
- (C) 3, 6
- (D) 3, 7
- (E) NONE

B

WHAT IS THE GREATEST COMMON  
DIVISOR OF 6, 18, 24?

- (A) 2
- (B) 3
- (C) 6
- (D) 4
- (E) NONE

C

WHICH TWO NUMBERS CONTAIN TWO  
FACTORS OF 45?

- (A) 10, 4
- (B) 15, 11
- (C) 3, 10
- (D) 9, 5
- (E) NONE

D

WHAT IS THE GREATEST COMMON  
DIVISOR OF 7, 14, 21?

- (A) 1
- (B) 11
- (C) 4
- (D) 5
- (E) NONE

E

WHICH PAIR OF NUMBERS CONTAIN  
TWO FACTORS OF 63?

- (A) 7, 9
- (B) 21, 4
- (C) 8, 9
- (D) 31, 3
- (E) NONE

A

WHAT IS THE GREATEST COMMON  
DIVISOR OF 7, 21, 63?

- (A) 9
- (B) 7
- (C) 3
- (D) 21
- (E) NONE

B

WHAT PAIR OF NUMBERS CONTAIN  
FACTORS OF 30?

- (A) 6, 24
- (B) 15, 4
- (C) 10, 3
- (D) 29, 1
- (E) NONE

C

WHAT IS THE GREATEST COMMON  
DIVISOR OF 9, 27, 81?

- (A) 3
- (B) 27
- (C) 21
- (D) 9
- (E) NONE

D

WHAT IS THE GREATEST COMMON  
DIVISOR OF 25, 50, 100?

- (A) 5
- (B) 10
- (C) 50
- (D) 2
- (E) NONE

E

WHICH PAIR OF NUMBERS CONTAIN  
TWO FACTORS OF 55?

- (A) 11, 5
- (B) 54, 1
- (C) 13, 5
- (D) 15, 3
- (E) NONE

A

WHAT IS THE GREATEST COMMON  
DIVISOR OF 12, 24, 144?

- (A) 6
- (B) 12
- (C) 4
- (D) 3
- (E) NONE

B

WHAT IS THE GREATEST COMMON  
DIVISOR OF 18, 27, 81?

- (A) 3
- (B) 6
- (C) 9
- (D) 18
- (E) NONE

C

WHICH PAIR OF NUMBERS CONTAIN  
TWO FACTORS OF 120?

- (A) 10, 10
- (B) 4, 8
- (C) 6, 8
- (D) 15, 8
- (E) NONE

D

WHICH PAIR OF NUMBERS CONTAIN  
TWO FACTORS OF 144?

- (A) 31, 5
- (B) 8, 20
- (C) 6, 7
- (D) 9, 11
- (E) NONE

E

TOMMY TOOK 2 APPLES, 1 ORANGE,  
AND 3 BANANAS TO SCHOOL? HOW  
MANY PIECES OF FRUIT DID HE  
HAVE?

- (A) 6
- (B) 5
- (C) 4
- (D) 3
- (E) NONE

A

JEAN BOUGHT A BALL FOR \$1.15 (A) \$0.46  
AND A COLORING BOOK FOR \$0.69. (B) \$1.84  
HOW MUCH WAS THE TOTAL? (C) \$1.89  
(D) \$2.84  
(E) NONE

B

IF YOU BOUGHT A DOZEN EGGS (A) 7  
AND BAKE A CAKE AND USE HALF (B) 5  
OF THE EGGS, HOW MANY ARE LEFT? (C) 6  
(D) 8  
(E) NONE

C

KIM'S CAT HAD THREE KITTENS AND (A) 7  
HER DOG HAD ONE PUPPY. HOW MANY (B) 2  
PETS WILL SHE NOW HAVE IN ALL? (C) 4  
(D) 6  
(E) NONE

D

A CLASSROOM HAD 8 ROWS OF DESKS (A) 14  
AND 6 DESKS IN A ROW. HOW MANY (B) 50  
DESKS ARE THERE IN THE ROOM? (C) 40  
(D) 12  
(E) NONE

E

A CLASSROOM HAS 7 ROWS OF DESKS (A) 45  
WITH 7 DESKS IN EACH ROW. FOUR (B) 49  
DESKS WERE REMOVED FROM THE ROOM. (C) 10  
HOW MANY DESKS ARE LEFT IN THE (D) 18  
ROOM? (E) NONE

A

ALICE BOUGHT A DRESS FOR \$12.95. (A) \$27.95  
SHE GAVE THE CLERK \$15.00. HOW (B) \$2.05  
MUCH CHANGE SHOULD SHE RECEIVE? (C) \$3.00  
(D) \$2.95  
(E) NONE

B

BOBBY WEIGHED 115 POUNDS IN (A) 115  
SEPTEMBER. IN DECEMBER HE HAD (B) 103  
GAINED 12 MORE POUNDS. HOW (C) 127  
MUCH DOES HE NOW WEIGH? (D) 130  
(E) NONE

C

MARIE BOUGHT A DOZEN EGGS FOR (A) \$1.97  
\$0.69, A BAG OF FLOUR FOR \$1.15 (B) \$1.83  
AND A CARTON OF MILK FOR \$0.99. (C) \$3.83  
HOW MUCH DID SHE HAVE TO PAY (D) \$2.83  
FOR THE GROCERIES? (E) NONE

D

LEE BOUGHT AN AUTOMOBILE FOR (A) \$500.00  
 \$900.00. HE PAID \$300.00 DOWN. (B) \$499.99  
 HOW MUCH HE HAVE LEFT TO PAY (C) \$700.00  
 FOR THE AUTOMOBILE? (D) \$1200.00  
 (E) NONE

E

LEE BOUGHT A CAR FOR \$800.00. (A) \$60.00  
 HE PAID \$200.00 DOWN AND WILL (B) \$100.00  
 PAY THE REST IN 10 EQUAL (C) \$6.00  
 PAYMENTS. HOW MUCH WILL THE (D) \$100.00  
 PAYMENTS BE? (E) NONE

A

JANE BOUGHT A DRESS FOR \$19.95, (A) \$11.50  
 A PAIR OF SHOES FOR \$12.50 AND (B) \$12.60  
 A PURSE FOR \$4.95. SHE GAVE THE (C) \$37.40  
 \$50.00. HOW MUCH CHANGE SHOULD (D) \$15.40  
 SHE RECEIVE? (E) NONE

B

JOHN BOUGHT A BOAT FOR \$1100.00. (A) \$100.00  
 HE PAID \$300.00 DOWN AND WILL PAY (B) \$200.00  
 THE REMAINDER IN 5 EQUAL PAYMENTS. (C) \$160.00  
 HOW MUCH WILL BE PAYMENTS BE? (D) \$80.00  
 (E) NONE

C

CHRIS DROVE 575 MILES ON TUESDAY (A) 461  
 AND 347 MILES ON WEDNESDAY. HOW (B) 228  
 MANY MILES DID CHRIS TOTAL FOR (C) 822  
 BOTH DAYS? (D) 922  
 (E) NONE

D

TOMMY HAD \$20.00 BUT SPENT \$3.00 (A) \$16.00  
 OF IT ON A RECORD. HOW MUCH WAS (B) 23.00  
 LEFT? (C) \$10.00  
 (D) \$19.00  
 (E) NONE

E

ACCORDING TO THE GRAPH BELOW (A) 2,000,000  
 WHAT IS THE POPULATION OF BOSTON? (B) 1,000,000  
 3,000,000! --WASHINGTON--- (C) 3,000,000  
 2,000,000! --BOSTON----- (D) 6,000,000  
 1,000,000! --ATLANTA----- (E) NONE OF THESE

A

JEAN \*\*\*\*\* WHICH PERSON (A) JEAN  
 CHRIS\*\*\*\*\* HAS THE MOST (B) CHRIS  
 PAT \*\*\*\*\* MARBLES? (C) PAT  
 KIM \*\*\*\*\* (D) KIM  
 -----MARBLES----- (E) NONE OF THESE

B



501b!--JEAN---- WHICH PERSON (A) JEAN  
 401b!--CHRIS--- WEIGHS 30 LBS? (B) CHRIS  
 301b!--PAT----- (C) PAT  
 201b!--KIM----- (D) LEE  
 101b!--LEE----- (E) NONE OF THESE  
 C

JEAN \*\*\*\*\* WHICH PERSON (A) JEAN  
 CHRIS\*\*\* HAS FIVE (B) CHRIS  
 PAT \*\*\*\*\* MARBLES? (C) PAT  
 LEE \*\*\*\*\* (D) LEE  
 (MARBLES) (E) NONE OF THESE  
 D

JEAN \*\*\*\*\* WHICH TWO (A) JEAN,CHRIS  
 CHRIS\*\*\* APPEAR TO (B) PAT,CHRIS  
 PAT \*\*\*\*\* HAVE EQUAL (C) PAT,LEE  
 LEE \*\*\*\*\* MARBLES? (D) JEAN,PAT  
 (MARBLES) (E) NONE OF THESE  
 E

JEAN !\*\* WHO HAS (A) JEAN  
 PAT !\*\*\*\* APPROXIMATELY (B) PAT  
 KIM !\*\*\*\*\* 10 APPLES? (C) KIM  
 LEE !\*\*\*\* (D) LEE  
 APPLES!10-20-30- (E) NONE OF THESE  
 A

JEAN !\*\*\*\*\* WHO HAS (A) JEAN  
 PAT !\*\*\*\*\* THE MOST (B) PAT  
 KIM !\*\*\*\*\* APPLES? (C) KIM  
 LEE !\*\*\*\*\* (D) LEE  
 APPLES!-10-20-30-40-50- (E) NONE OF THESE  
 B

JEAN !\*\* WHO HAS (A) JEAN  
 PAT !\*\*\*\*\* ABOUT 30 (B) PAT  
 KIM !\*\*\*\*\* MARBLES? (C) KIM  
 LEE !\*\*\*\*\* (D) LEE  
 MARBLES!--10--20--30--40--50-- (E) NONE OF THESE  
 C

JEAN !\* ABOUT HOW MANY (A) 5  
 PAT !\*\*\*\*\* MARBLES DOES (B) 30  
 KIM !\*\*\*\*\* PAT HAVE? (C) 45  
 LEE !\*\*\*\*\* (D) 15  
 MARBLES!10-20-30-40-50 (E) NONE  
 D

JEAN !\*\*\*\*\* WHICH TWO (A) JEAN,LEE  
 PAT !\*\*\*\*\* PEOPLE (B) PAT,LEE  
 KIM !\*\*\*\*\* APPEAR TO (C) KIM,PAT  
 LEE !\*\*\*\*\* HAVE 30 (D) JEAN,KIM  
 MARBLES!10-20-30-40 MARBLES? (E) NONE  
 E

THOUSAND 4! \* WHICH (A) 1970  
 CASES 3! \* YEAR HAS (B) 1950  
 OF 2! \* 2,000 (C) 1960  
 FLU 1! \* CASES OF (D) 1980  
 (YEAR) !1950-1960-1970-1980 FLU? (E) NONE

A

THOUSAND4! \* ABOUT HOW (A)1000  
 CASES 3! \* MANY CASES(B)2500  
 OF 2! \* WERE THERE(C)4000  
 FLU 1! \* IN 1955? (D)500  
 (YEAR) !1950-1960-1970-1980 (E)NONE

B

THOUSAND4! \* WHICH YEAR(A)1980  
 CASES 3! \* HAS THE (B)1970  
 OF 2! \* MOST CASES(C)1950  
 FLU 1! \* OF FLU? (D)1960  
 (YEAR) !1950-1960-1970-1980- (E)NONE

C

NUMBER 40! \* WHICH 2 (A) JEAN,KIM  
 OF 30! \* PEOPLE ARE(B) JEAN,PAT  
 MARBLES20! \* THE (C) KIM,PAT  
 10! \* AVERAGE? (D) KIM,LEE  
 (PERSON) !JEAN-KIM-PAT-LEE (E) NONE

D

NUMBER 40! \* WHO HAS (A) KIM,LEE  
 OF 30! \* EQUAL (B) PAT,JEAN  
 MARBLES20! \* NUMBERS OF(C) PAT,LEE  
 10! \* MARBLES? (D) JEAN,LEE  
 (PERSON) !JEAN-KIM-PAT-LEE (E) NONE

E

WHAT IS THE AREA OF (A) 24 SQ. IN.  
 A RECTANGLE WITH A (B) 10 SQ. IN.  
 BASE OF 4 IN. AND AN (C) 12 SQ. IN.  
 ALTITUDE OF 6 IN.? (D) 20 SQ. IN.  
 (E) NONE OF THESE

A

HOW MANY SQUARE FEET (A) 16 SQ. FT.  
 ARE THERE IN A CARPET (B) 64 SQ. FT.  
 STRIP 8 FT. LONG AND (C) 32 SQ. FT.  
 8 FT. WIDE? (D) 66 SQ. FT.  
 (E) NONE OF THESE

B

WHAT IS THE AREA OF A (A) 9 SQ. IN.  
 RECTANGLE WITH A BASE (B) 27 SQ. IN.  
 OF 6 IN. AND AN (C) 18 SQ. IN.  
 ALTITUDE OF 3 IN.? (D) 36 SQ. IN.  
 (E) NONE OF THESE

C

WHAT IS THE AREA OF A SQUARE WITH A SIDE OF 5 IN.?

(A) 5 SQ. IN.  
(B) 10 SQ. IN.  
(C) 15 SQ. IN.  
(D) 25 SQ. IN.  
(E) NONE OF THESE

D

WHAT IS THE AREA OF A PARALLELOGRAM WITH A BASE OF 10 IN. AND AN ALTITUDE OF 5 IN.?

(A) 5 SQ. IN.  
(B) 10 SQ. IN.  
(C)  $7\frac{1}{2}$  SQ. IN.  
(D) 9 SQ. IN.  
(E) NONE OF THESE

E

WHAT IS THE AREA OF A RECTANGLE WITH A BASE OF 11 IN. AND AN ALTITUDE OF 13 IN.?

(A) 143 SQ. IN.  
(B) 24 SQ. IN.  
(C) 103 SQ. IN.  
(D) 144 SQ. IN.  
(E) NONE OF THESE

A

WHAT IS THE AREA OF A RIGHT TRIANGLE WITH A BASE OF 7 IN. AND THE HEIGHT OF 9 IN.?

(A) 16 SQ. IN.  
(B)  $31\frac{1}{2}$  SQ. IN.  
(C) 32 SQ. IN.  
(D) 63 SQ. IN.  
(E) NONE OF THESE

B

HOW MANY SQUARE FEET ARE THERE IN A STRIP OF CARPET 8 FT. WIDE AND 12 FT. LONG?

(A) 108 SQ. FT.  
(B) 20 SQ. FT.  
(C) 96 SQ. FT.  
(D) 40 SQ. FT.  
(E) NONE OF THESE

C

WHAT IS THE AREA OF A SQUARE WITH A SIDE OF 12 FT.?

(A) 14 SQ. FT.  
(B) 24 SQ. FT.  
(C) 72 SQ. FT.  
(D) 144 SQ. FT.  
(E) NONE OF THESE

D

WHAT IS THE AREA OF A PARALLELOGRAM WITH A BASE OF 20 IN. AND AN ALTITUDE OF 12 IN.?

(A) 16 SQ. IN.  
(B) 8 SQ. IN.  
(C) 4 SQ. IN.  
(D) 144 SQ. IN.  
(E) NONE OF THESE

E

A CARPET FOR A ROOM MEASURES 10 FT. LONG AND 13 FT. WIDE. HOW MANY SQUARE FEET DOES IT CONTAIN?

(A) 130 SQ. FT.  
(B) 13 SQ. FT.  
(C) 23 SQ. FT.  
(D) 46 SQ. FT.  
(E) NONE OF THESE

A

WHAT IS THE AREA OF A (A) 31 SQ. IN.  
RECTANGLE WITH A BASE (B) 238 SQ. IN.  
OF 17 IN. AND AN (C) 62 SQ. IN.  
ALTITUDE OF 14 INCHES? (D) 3 SQ. IN.  
(E) NONE OF THESE

B

WHAT IS THE AREA OF A (A) 17 SQ. IN.  
PARALLELOGRAM WITH A (B) 34 SQ. IN.  
BASE OF 10 IN. AND AN (C) 70 SQ. IN.  
ALTITUDE OF 7 INCHES (D) 35 SQ. IN.  
THE WIDTH OF 3 INCHES? (E) NONE OF THESE

C

A BOX IS 7 IN. LONG, (A) 26 CU. IN.  
4 IN. WIDE, AND 2 IN. (B) 13 CU. IN.  
DEEP. HOW MANY CUBIC (C) 30 CU. IN.  
INCHES DOES IT CONTAIN? (D) 56 CU. IN.  
(E) NONE OF THESE

D

A BOX IS 10 IN. LONG, (A) 45 CU. IN.  
5 IN. WIDE, AND 3 IN. (B) 18 CU. IN.  
DEEP. HOW MANY CUBIC (C) 80 CU. IN.  
INCHES DOES IT CONTAIN? (D) 65 CU. IN.  
(E) NONE OF THESE

E

ON A MAP,  $1/2$  IN.=20 MILES. (A) 40  
IF 2 CITIES ARE 1 INCH APART (B) 20  
ON THE MAP, HOW MANY MILES (C) 60  
APART ARE THEY? (D) 80  
(E) NONE OF THESE

A

JOE MISSED 5 PROBLEMS ON A (A) 7  
TEST, BUT DID 50% CORRECTLY. (B) 10  
HOW MANY PROBLEMS WERE THERE (C) 15  
IN THE TEST? (D) 20  
(E) NONE OF THESE

B

PAT WEIGHS 80 POUNDS, LEE (A) 40  
WEIGHS 100 POUNDS, AND JEAN (B) 300  
WEIGHS 120 POUNDS. WHAT IS (C) 100  
THEIR AVERAGE WEIGHT? (D) 120  
(E) NONE OF THESE

C

HOW MANY SQUARE FEET ARE (A) 90 SQ. FT.  
THERE IN A ROOM 10 FT. BY (B) 80 SQ. FT.  
10 FT.? (C) 20 SQ. FT.  
(D) 100 SQ. FT.  
(E) NONE OF THESE

D

ON A MAP  $1/2$  IN.=50 MILES. (A) 100  
 IF 2 CITIES ARE  $1\ 1/2$  INCHES (B) 50  
 APART ON THE MAP, HOW MANY (C) 75  
 MILES APART ARE THEY? (D) 125  
 (E) NONE OF THESE

E

LEE HAD \$20 BUT SPENT \$15 (A) 75%  
 OF IT. WHAT PERCENT DID LEE (B) 25%  
 SPEND? (C) 50%  
 (D)  $33\ 1/3\%$   
 (E) NONE OF THESE

A

CHRIS BOUGHT A CHAIR. THE (A) \$120.00  
 LIST PRICE WAS \$150.00, BUT (B) 105.00  
 THERE WAS A 30% DISCOUNT. (C) \$100.00  
 HOW MUCH DID CHRIS PAY FOR (D) \$50.00  
 FOR THE CHAIR? (E) NONE OF THESE

B

A PERSON RECEIVED 9 PERCENT (A) \$791.00  
 INTEREST ON A LOAN OF \$800.00 (B) \$17.00  
 FOR 1 YEAR. HOW MUCH (C) \$72.00  
 INTEREST DID THE PERSON (D) \$809.00  
 RECEIVE? (E) NONE OF THESE

C

ON A MAP,  $1/4$  IN.=20 MILES. (A) 50  
 IF 2 CITIES ARE  $2\ 1/4$  INCHES (B) 40  
 APART ON THE MAP, HOW MANY (C) 160  
 MILES APART ARE THEY? (D) 180  
 (E) NONE OF THESE

D

IF TEN PERCENT OF A CLASS OF (A) 27  
 30 STUDENTS MISS SCHOOL, HOW (B) 9  
 MANY STUDENTS MISSED CLASS? (C) 5  
 (D) 6  
 (E) NONE OF THESE

E

KIM SOLD MAGAZINE SUBSCRIPTIONS (A) \$7.50  
 FOR \$3 EACH, RECEIVING A 25% (B) \$0.75  
 COMMISSION ON THE SALES. IF (C) \$45.00  
 10 SUBSCRIPTIONS WERE SOLD, HOW (D) \$48.00  
 MUCH DID KIM EARN? (E) NONE OF THESE

A

TOGETHER PAT, KIM, AND LEE (A) 50%  
 BOUGHT A GIFT FOR JEAN THAT (B) 40%  
 COST \$25.00. PAT GAVE \$10.00, (C) 30%  
 KIM GAVE \$7.50 AND LEE GAVE (D) 20%  
 \$7.50. WHAT % DID PAT GIVE? (E) NONE OF THESE

B

CHRIS BOUGHT A BEDROOM SUITE (A) \$200.00  
FOR \$900.00, BUT RECEIVED A (B) \$225.00  
25% DISCOUNT. HOW MUCH DID (C) \$675.00  
CHRIS PAY? (D) \$650.00  
(E) NONE OF THESE

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C

PAT HAD A TEST OF 60 (A) 25%  
QUESTIONS, BUT MISSED 8 OF (B) 20%  
THEM. WHAT PERCENT DID PAT (C) 15%  
MISS? (D)  $13 \frac{1}{3}\%$   
(E) NONE OF THESE

D

JEAN SHOT 20 GOALS IN A (A) 10%  
BALLGAME, BUT MISSED 5 OF THE (B) 15%  
GOALS. WHAT PERCENTAGE DID (C) 5%  
JEAN MISS? (D) 35%  
(E) NONE OF THESE

E

APPENDIX C  
INFORMED CONSENT SUBJECT FORM

## INFORMED CONSENT

A Computerized Diagnostic Instrument for the Assessment and Development of Basic Math Skills in Vocational Education  
Mr. Odell D. Wilson

INFORMATION

You are being asked to participate in a research study (experiment) conducted by Mr. Odell Wilson, a doctoral candidate at East Tennessee State University. The purpose of this study is to determine characteristics of entering vocational students in Kentucky area vocational schools and to develop a computerized diagnostic instrument and tutorial package for assisting students in the mastery of necessary basic skills in mathematics.

You will be asked to answer an anonymous multiple choice math problems test. Your identity will remain anonymous. There is no risk associated with participation in this study. The only inconvenience associated with participation in this study is the small amount of time which will be used in taking the test.

CONSENT

I understand the procedures to be used in this study and the possible risks involved. If I have any further questions about this study, I understand that I can call Mr. Odell Wilson at (606) 589-2145 or I can speak with the classroom instructor at the vocational school, and they will try to answer any additional questions that I might have. I understand that I will receive a copy of this form to read at my leisure.

I also understand that while my rights and privacy will be maintained, the Secretary of the Department of Health and Human Services and the ETSU Institutional Review Board do have free access to any information obtained in this study should it become necessary and I freely and voluntarily choose to participate. I understand that I may withdraw at any time without prejudice to me. I also understand that while East Tennessee State University does not provide compensation for medical treatment other than emergency first aid, for any physical injury which may occur as a result of my participation as a subject in this study, claims arising against ETSU or any of its agents or employees may be submitted to the Tennessee Claims Commission for disposition to the extent allowable as provided under TCA Section 9-8-307. Further information concerning this may be obtained from the chairman of the Institutional Review Board.

\_\_\_\_\_  
Date

\_\_\_\_\_  
Signature of Volunteer

\_\_\_\_\_  
Date

\_\_\_\_\_  
Signature of Investigator



ODELL D. WILSON

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