CALIFORNIA STATE UNIVERSITY, NORTHRIDGE

THE IMPLEMENTATION, ORGANIZATION, AND EVALUATION
OF THE PREP SESSIONS FOR THE MATHEMATICS SECTION
OF THE GRADUATE RECORD EXAMINATION AT CALIFORNIA
STATE UNIVERSITY AT NORTHRIDGE

A project submitted in partial satisfaction of the
requirements for the degree of Master of Arts in

Secondary Education

by

Jerry Bobrow

January, 1976
The graduate project of Jerry Bobrow is approved:

California State University, Northridge
December, 1975
DEDICATION

TO MY LOVING WIFE, SUSAN, FOR ALL OF HER PATIENCE, MORAL SUPPORT, AND INFINITE ASSISTANCE IN HELPING ME COMPLETE THIS PROJECT.
ACKNOWLEDGEMENTS

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The CSUN Testing and Graduate Studies Office
All Participants in the Actual Sessions
PREFACE

With acceptance into graduate study programs becoming more and more competitive, students have a greater need to score well on the Graduate Record Examination. The score on this examination is widely used by colleges and universities as a criterion for graduate entrance; as a result the examination itself holds the future of many students in its grasp. Many undergraduate institutions have met this need by offering a session to aid students in achieving maximum scores. Additionally, testing companies exist that profess to help students and commercial review manuals are plentiful. As a leader in meeting the needs of students, CSUN offers a unique extended program of cost-free GRE Prep Sessions that have evoked an enthusiastic response in the participants. The program professes a uniqueness because of its flexibility in adapting to individual needs. Diverse elements -- such as being low key and informal, yet highly systemized and structured -- are not opposites but complements. Valuing both the needs of the individual and of the group is a trademark of the sessions. The author's techniques and results are presented in the following pages. It is his hope that they will be of use to others in organizing and structuring similar programs.
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ABSTRACT

THE IMPLEMENTATION, ORGANIZATION, AND EVALUATION
OF THE PREP SESSIONS FOR THE MATHEMATICS SECTION
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This project is designed to provide a source of material for use in a 4 to 5 week program to prepare students for the Graduate Record Examination Mathematics Section. It is also intended to offer an evaluation of the effectiveness of this program at California State University at Northridge, and a model for similar evaluations of effectiveness elsewhere.

This evaluation was done with two test groups in two major sections: academic preparation and test anxiety. Evaluation of the academic and test-taking skills was accomplished by the use of pre- and posttests with questions similar to those on the Graduate Record Examination Mathematics Section. Attitudinal evaluation was done through pre- and postattitudinal survey questionnaires.
rating positive and negative feelings about the examination.

This paper has been divided into seven sections:
Chapter I - The Origin of the GRE Prep Sessions; Chapter II - The Participants; Chapter III - The Actual Sessions; Chapter IV - Program Evaluation by Participants; Chapter V - Attitudinal Evaluation of Participants; Chapter VI - Evaluation and Analysis of Academic Preparation; and Chapter VII - Summary. All materials used in the sessions are included and explained.

The conclusions reached by the use of statistical analysis showed a significant improvement in the academic and test-taking skills as well as a noted relief in the test anxiety of the participants. The program would have to be termed extremely successful in meeting accepted standards of evaluation.
CHAPTER I

THE ORIGIN OF THE GRE PREP SESSIONS

The Graduate Record Examination (GRE) Prep Sessions originated in the California State University at Northridge (CSUN) Counseling Center as an anxiety reduction session organized by counselor-psychologist Bill Huling. In the course of his counseling, it became apparent that a great number of students were coming in for counseling and test anxiety relief related to the GRE. Because of the large number of students involved, establishing specific cost-free GRE Prep Sessions for the students seemed a worthwhile and extremely beneficial endeavor.

Dr. Emil Lucki, Dean of Graduate Studies, encouraged the development of a pilot program, and the first GRE Prep Session was initiated by Mr. Huling early in the Fall of 1973. After a number of sessions dealing with test anxiety and special academic preparation for the examination, the observation was made that most students were specifically in need of preparation in mathematics and reading skills. Dr. Stanley L. Singer, Associate Dean of Counseling and Testing, contacted Noel Korn, Director of the Learning Resource Center (LRC) on campus, in search of a mathematics-education specialist skilled in reviewing basic college mathematics. The responsibility for verbal
section preparation was directed to the Reading Lab in the LRC, which provided individual auto-tutorial instruction, but the mathematics section -- being more technical -- needed a more person-to-person approach. Mr. Korn felt that the author, having served in the capacity of Head Mathematics Tutor at the LRC and having completed three years of full-time teaching, was well suited to such a task.

After much research into the structure and content of the GRE, which included discussion with testing companies, careful analysis of professionally published GRE Review Manuals (ARCO, Gruber & Gruber, Barrons, and Regenry), and a number of conferences with Mr. Huling and Mr. Korn, the author felt confident to direct the sessions. The sessions soon took on a more academic outlook.

The mathematics section was composed largely of problems involving arithmetic, high school algebra, plane and analytic geometry, graph analysis, and simple logic. After a few meetings, it became apparent that the great majority of participants had not been exposed to much mathematics for quite some time and was in need of either basic mathematics review or a first exposure to all of the above areas.

Previous negative experiences with mathematics, as well as long lapse of time since last exposure, contributed to anxiety and lack of confidence in the
participants. The program's objective was that academic preparation, along with familiarity with the structure of the GRE, would serve to alleviate both lack of mathematical proficiency and anxiety toward the exam in general.

Alternate meetings were led by Mr. Huling and the author, with Mr. Huling focusing on test anxiety and graph analysis. The author conducted the meetings stressing basic mathematics review and sample test questions. As the sessions continued, it became apparent that test anxiety was diminishing as confidence in mathematics ability grew. Accordingly, more time was spent on instilling and reviewing mathematics skills than in strictly relieving test anxiety. At this point, and also because of prior commitments, Mr. Huling offered to limit his role to conducting periodic meetings on test anxiety and graph analysis, and proposed that the author become sole organizer and implementer of the program.

By the spring of 1974, the author had completely structured the sessions, and then started gathering and writing review materials. As a result of this added background, the final three sessions in the spring of 1975 were conducted entirely by the author. It should be noted here, that the structure of the meetings was aimed at combining small and large group instruction with special provisions made for meeting individual needs. The program's flexibility was the key to adjusting to the needs of each different group. The "traditional" class
structure was deemed unsuited for these sessions and was avoided.

With each successive session, changes, revisions and improvements were made, based on experience gained from the previous sessions and feedback from past participants. This feedback was acquired from survey questionnaires given at the start and finish of each session. Data from these surveys, evaluation at conclusion of meetings, plus test scores from pre- and posttests administered during each session gave an excellent basis for evaluating the effectiveness of the program and for implementing needed revisions.

Meetings were varied in length from 1 to 2½ hours in an attempt to achieve maximum effectiveness. Meeting nights were originally scheduled at 7-9:30pm on Tuesday and Thursday. These days and times were altered to 7-9pm on Monday and Wednesday for the convenience of the students. Afternoon sessions were also attempted, but enrollment was minimal.

The effectiveness of the number of meetings per session was also tested. Early sessions varied from 10 to 18 meetings total, but the two sessions being evaluated here, Test Session Number One (TS#1) and Test Session Number Two (TS#2), were of 8 and 10 meetings respectively. At the director's request, these sessions were streamlined to give the students responsibility and to get them to take advantage of available self-instructional
materials. The LRC did not wish to provide specific course offerings as such; cost effectiveness had to be considered.

After completion of TS#1, it was agreed that more meetings were necessary because the efficiency of the program appeared to have been hindered by the lack of time. More time was necessary to work actual practice problems. This was corrected and resolved by the addition of two extra meetings in TS#2.

The meetings were held in a variety of rooms on campus. This was in search of a room with proper facilities and desired atmosphere. Eventually alterations were made in the LRC in conjunction with the Instructional Materials Lab to fit all of the desired requirements. These requirements included tables for grouping, blackboards, convenient electrical outlets, and a movie screen.

While earlier sessions attracted from 5 to 25 students, the number grew to a high of 82 in October of 1974. To insure no loss of effectiveness of the program due to over-enrollment and unmanageable grouping, students not taking the upcoming GRE were requested to attend the next session.

This sizeable increase in enrollment can be attributed to three basic factors: a) improved announcements and publicity by the LRC, b) major increase in word-of-mouth recommendations by past participants, and c) testing office, graduate studies, and department referrals.
Finally, the LRC and Counseling Center should be given credit for continually taking signups for the sessions at their offices and by telephone. The LRC then contacted all registrants by phone and mail to inform and remind them of the times, dates, and place of the first meeting as well as of materials needed (Appendix A-Letter to Participants). This total effort by all involved, past and present, has helped to make the GRE Prep Sessions a "household word" on campus.
CHAPTER II
THE PARTICIPANTS

The participants involved in TS#1 and TS#2 were asked to complete a questionnaire on general information and mathematics background at the first meeting (Appendix B-Pre-Questionnaire). The general overview of participants and the charts on the following pages were all compiled from the data on the questionnaires. The structure of the program was very heavily dependent upon the mathematics level and background of the participants. Therefore, the following information was given great consideration in the formulation of the level of the complete session.

Test Session #1

Most TS#1 participants were presently attending college - average age 29 years. The group consisted of more women than men, which may be attributed to the fact that "women tend to score lower than men on the mathematics section of the test" according to the 1974 Educational Testing Service (ETS) Report. Very few students had taken the GRE previously and only about one-third had taken similar tests. None of these students had previously been to any prep sessions. The great majority of the TS#1 participants did not have any extensive mathematics
training. Those students with extensive training had not used their skills in over ten years.

Test Session #2

Participants in TS#2 were very similar to those in TS#1 with one notable difference -- slightly over one-half of the participants were presently attending college. Over 80% of the TS#1 members were presently in college. The average age for TS#2 was 33 years. This group also consisted of more women than men and only about one-fourth of the total having any experience in taking this type of test. One-fifth of this group had participated in a previous GRE prep session. Over 80% of this group lacked any extensive mathematics training. The other 20% had not used their higher mathematics in over 12 years. Over 85% of the participants combined, in TS#1 and TS#2, had not taken any type of mathematics course within the past 3 years.

Group Changes

The composition of each session changed slightly from meeting to meeting as some new students appeared and others disappeared in each session. Over 54 different students attended TS#1 in all, yet only 21 could be included in this study, because only they were present at the appropriate evaluation meetings. TS#2 had a similar situation with over 45 different students attending, but only 17 available for pre- and posttesting. Numbers in attendance ranged from 17 to 45 students at any one
meeting with an average of 31 in attendance at each meeting.

Details as to the general information and mathematics background can be seen more closely in the charts (presented separately for TS#1 and TS#2) on the following pages.
TEST SESSION #1

GENERAL INFORMATION

Presently Attending Coll.
Yes - 81%
No - 19%

Age Group
20-25 43%
26-30 19%
31-35 24%
36-40 4.6%
41-45 4.6%
46-50 4.6%

Sex
Male - 43%
Female - 57%

Highest Degree
Non - 28%
BA - 67%
MA - 5%

Taken GRE Previously
Yes - 10%
No - 90%

Taken Tests Similar to GRE
Yes - 33%
No - 67%
TEST SESSION #1

MATH BACKGROUND

Algebra
Yes - 95%
No - 5%

Plane Geometry
Yes - 81%
No - 19%

Analytic Geometry
Yes - 43%
No - 57%

Graphs and Charts
Yes - 43%
No - 57%

Statistics
Yes - 67%
No - 33%

Trigonometry
Yes - 19%
No - 81%

Calculus
Yes - 14%
No - 86%
TEST SESSION #2

GENERAL INFORMATION

Presently Attending Coll.
Yes - 59%
No - 41%

Age Group
21-25 29%
26-30 12%
31-35 35%
36-40 0%
41-46 12%
46-50 12%

Sex
Male - 47%
Female - 53%

Highest Degree Earned
Non - 29%
BA - 59%
MA - 12%

Taken GRE Previously
Yes - 12%
No - 88%

Taken Test Similar to GRE
Yes - 24%
No - 76%
TEST SESSION #2
MATH BACKGROUND

Algebra
Yes - 94%
No - 6%

Analytic Geometry
Yes - 29%
No - 71%

Statistics
Yes - 65%
No - 35%

Plane Geometry
Yes - 76%
No - 24%

Graphs and Charts
Yes - 35%
No - 65%

Trigonometry
Yes - 41%
No - 59%

Calculus
Yes - 18%
No - 82%
CHAPTER III
THE ACTUAL MEETINGS

The prep session meetings consisted of four areas of emphasis: 1) introduction to the program, 2) basic review of mathematics, 3) test anxiety reduction, and 4) practicing test problems.

Introduction to Program

The introductory meeting focused on three areas: 1) overview of the meetings, 2) familiarization with the GRE, and 3) pretest and questionnaire.

The overview of the meetings emphasized the two prime objectives of the program, to relieve test anxiety and to offer enough mathematics review to insure competence in basic mathematics skills. Presentation of techniques and materials followed. Students were told that the class format was intended to be informal and geared to individual needs and weaknesses. Class participation was not only encouraged, but was crucial to the success of the complete session. Questions were welcomed as essential learning tools.

The required text was Gruber and Gruber's GRE Aptitude Test Manual (text), which each student was to bring with him to the first meeting. (This information
was mailed to students prior to the first meeting -- see Appendix A - Letter to Participants.)

Students were instructed that all mathematics review assignments were keyed by code to the mathematics review section of the text, where students could quickly check their answers and find explanations. Slide filmstrips would also be used as a visual supplement to concepts covered in class.

Special mention was made of additional materials available at the LRC for those students in need of extra help. Students were encouraged to see the instructor about individual weaknesses so that they could be set on a program of remedial self-instruction at the LRC (Appendix C - List of Available Materials).

Next, a brief overview of the subject areas to be covered during the session was given, specifying the order in which they would be presented (Appendix D - Prep Session Meetings).

To help reduce test anxiety, an introductory look at the format and content of the GRE was taken using the Educational Testing Service Information Bulletin. Students were familiarized with subject area, types of questions, and scoring procedures. Students were instructed to carefully check the amount of time and number of questions for each section, and make a time-plan as making good use of their time would be a key to their success.
Finally students were exposed to questions that were similar to those they would be encountering on the GRE, by taking a sample test. This test was composed of representative questions taken from the GRE Mathematics Review Manual by Gruber and Gruber. Time allotment per question was the same as that on the GRE. (Appendix G - Sample Tests A & D, The Pretests.) Students pinpointed their areas of weakness in terms of the basic skill needed as the test was corrected, and problems were itemized and analyzed (Appendix H - Self-Evaluation Form).

The pretest score was a valuable tool for comparison at the conclusion of the session. A questionnaire accompanied the pretest and provided information regarding students' backgrounds, and both positive and negative feelings toward the GRE (Appendix B - Pre-Questionnaire).

The meeting was concluded with a question and answer period and some general discussion of test-taking strategies.

A Basic Review of Mathematics

The second, third, and fourth meetings were devoted to reviewing basic mathematical concepts which were indicated as areas of weakness by many students in the questionnaire.

Meeting two opened with a discussion of our number system and basic mathematical terminology. This was
followed by an explanation of basic mathematical symbols in an effort to familiarize students with the quantitative language of the examination (Appendix I - Mathematical Symbols). The remainder of meeting two was used to cover arithmetic, while basic algebra, plan and analytic geometry, and graph reading were the major topics of the next two meetings. Time was set aside for questions and a brief evaluation of the pace and progress of the session at the end of each meeting. (Assignments for these meetings can be viewed in Appendices J through M.)

Test Anxiety Reduction and Practicing Test Problems

After a light review of basic mathematics, the remaining meetings were devoted to practicing test problems, and reduction of test anxiety. The last third of the final meetings concentrated on the importance of having a positive attitude and reliable test-taking techniques. Students were advised to: 1) read the test directions carefully to avoid confusion or misunderstanding; 2) answer the simplest problems first, returning to the more difficult ones; 3) use a simple coding system to denote extremely difficult problems; 4) eliminate ridiculous answers where possible; 5) look for ways to simplify problems; and 6) make educated guesses where one or more choices could be eliminated. An additional test-taking "Do's and Don'ts" list was distributed (Appendix N - Do's and Don'ts).
The majority of the time in the last meetings was spent on working sample problems. This was done to help students build up a library of problems that they could work easily and to give them insight into techniques for solving other related problems. Students were assigned problems and Practice Tests 1 and 2 in the text, to be taken slowly. They were even encouraged to check the answers and methods described in the text after working each problem. The emphasis was on familiarizing students with most of the types of problems they might encounter. Practice Tests 3, 4, and 5 were assigned as homework after each meeting to be taken under actual test conditions of timing and use of answer sheets. This was done to build speed and accuracy while letting the student establish his own pace for maximum effort. The problems and tests assigned were of increasing difficulty as the meetings progressed. The instructor stressed that students should learn their limitations on the test-type question, so they would not spend any time on problems that were not in their realm of knowledge. This time would be used more effectively on the easily workable problems.

Finally, following a brief overall review, a post-simulation test was administered, corrected, and briefly analyzed (Appendix 0 - Posttests B & C). Participants concluded the session by completing an evaluation form and
discussing the complete session (Appendix P - Final Evaluation Form).
CHAPTER IV

PROGRAM EVALUATION BY PARTICIPANTS

At the final meeting of each session the students were given a retrospective questionnaire which included a major section for student evaluation of the session (Appendix P - Final Evaluation Form). Students in TS#1 and TS#2 were first asked to evaluate the total session for helpfulness. All participants felt that the sessions were worthwhile and helpful; 42% felt the sessions were extremely helpful. All comments were very positive and praised the program. Some of the typical comments were:

"Extremely helpful!"

"Hope sessions will be continued!"

"I was very impressed with the whole program."

"Appreciate the session for no charge."

"Excellent review of mathematics!"

"More sessions needed!"

"Very at ease review situation, enjoyable."

"Session has given me a very positive attitude."

After the general rating, students were asked to rate and comment on specific sections of the program and were given a rating scale ranging down from 5 for excellent to 1 for poor. The results for each session are clearly charted on the following pages.
TS#2 PROGRAM EVALUATION
BY PARTICIPANTS

[Graph showing evaluation ratings for various aspects of the program]

- EXCELLENT: 5
- ABOVE AVERAGE: 4
- AVERAGE: 3
- BELOW AVERAGE: 2
- POOR: 1

[Graph categories include: LENGTH OF SESSION (10 meetings), LENGTH OF MEETINGS (7/4-2 hrs), MATERIALS COVERED, HANDOUTS, INSTRUCTION, ASSIGNMENTS, OVERALL RATING AVERAGE]
CHAPTER V
ATTITUDINAL EVALUATION OF PARTICIPANTS

The sessions were evaluated as to their effectiveness in building a positive, or more positive, attitude and relieving test anxiety. This was accomplished by comparing pre- and postattitudinal survey questionnaires rating positive and negative feelings about the GRE Mathematics Section (Appendices B & P - Pre- and Post-Questionnaires).

Test Session #1

In the pre-questionnaire completed at the initial meeting of TS#1, 81% of the students had negative feelings about the examination; among the 81% were a group (48% of all the students) who were more than apprehensive. Expressions in this latter group ranged from deep anxiety to panic. No feeling at all was expressed by 19% of the students. None of the students had any positive feeling about the examination.

Most students explained their negativeness as due to a lack of confidence in their own test-taking abilities and mathematics knowledge. A number of students actually resented taking the GRE as a determiner of their future.

At the final meeting of TS#1 the post-questionnaire was completed (Appendix P - Final Evaluation Form). The
students were once again asked to rate their feelings about the examination. In this evaluation, 67% had now gained a positive outlook, while all students' feelings were noted as more positive than in the first meeting. Of the 67% with positive feelings, a group (19% of all the students) was eager to see how well they could do. Twenty-four percent rated themselves as having mixed feelings--much better about the examination, but still anxious or "still a little nervous, but more confident." Slightly under 10% were still apprehensive, but were more positive. The attitudinal Survey Graph on the following page will give a clear picture of the change in attitude.
TEST SESSION #1 GRE ATTITUDE SURVEY

% of students

Attitudes


48 38 10 19 24 48 19

Pre Post
Test Session #2

Participants in TS#2 also used the pre- and post-attitudinal survey questionnaires with results similar to TS#1. Eighty-two percent of the students showed negative feelings towards the examination in the first questionnaire; among the 82% a group (35% of all the students) stated a deep concern and fear. A lack of feeling was expressed by 18%, but none of the students expressed any positive feelings.

The negative feelings were explained by most students in TS#2 in a manner very similar to those in TS#1. They felt it was due to a lack of confidence in their own test-taking abilities and competence in subject matter. These students also questioned the validity of the actual GRE as a measure of their talent.

Using the post-questionnaire at the final meeting, students again rated their feelings about the examination. Seventy-one percent had gained a positive outlook with 94% expressing a more positive outlook than in the pre-questionnaire. Six percent were eager to take the examination; another 6% showed mixed feelings, not decidedly negative or positive. Seventeen percent of the students were still anxious, but mentioned that their anxiety had decreased appreciably. Six percent explained that there was still a great deal of anxiety due to lack of study time and failure to follow through on assignments. The TS#2 Attitude Survey Graph on the following
In conclusion, it is more than apparent from the data presented in this chapter that TS#1 and TS#2 actually relieved test anxiety and gave a more positive attitude to participants relative to taking the GRE Mathematics Section.
TEST SESSION #2 GRE ATTITUDE SURVEY

Graph showing the percentage of students with different attitudes before and after an intervention.

- Pre: Very Neg: 35, Neg: 47, 0: 17, Post: 65
- Post: Very Pos: 6
CHAPTER VI
EVALUATION AND ANALYSIS OF ACADEMIC PREPARATION
IN THE AREA OF MATHEMATICS SKILLS

This chapter describes the types of data used to evaluate how well the program prepared students to answer mathematics questions similar to those on the GRE. The statistical methods used to analyze and interpret the results are presented.

Research and Construction

This evaluation was accomplished by the use of pre- and posttests carefully constructed after researching the GRE Mathematics Section. The GRE Information Bulletin supplied by the Educational Testing Service and commercial study manuals published by ARCO, Barron's, Regenry, and Gruber and Gruber were instrumental in the construction. These manuals all professed to have problems very similar to the actual GRE; research supported their claim. The results of this research were that 32% of the questions used some algebraic concepts, 25% used only simple arithmetic, 19% involved concepts of plane geometry, 4% dealt with analytic geometry, and the remaining 20% were devoted to graph and chart reading. All sources noted that there were many forms of the examination and the types of
problems could vary greatly from one GRE to the next. Taking this into consideration, the above percentages seemed to be a good basis for the construction of the pre- and posttests (Appendices G & O). The Mathematics Review Manual by Gruber and Gruber appeared to fit the above subject emphasis best, so the majority of problems used in pre- and posttests came from this source. (The use of this manual was later substantiated as the ETS published a sample test with nearly identical problems.) It should also be noted that a great number of the same problems appeared in the test review manuals of the different companies.

Tests and Data

The pre- and posttests consisted of 30 multiple choice problems with a time limit of 40 minutes. This was (in proportion) exactly paralleled in time and subject to the GRE Mathematics Section. The use of an IBM-type answer sheet helped simulate the GRE conditions (Appendix F - Answer Sheet). Tests were corrected by the instructor and given a numerical adjusted score using the GRE formula as given by the ETS. In other words, the adjusted score was calculated using the formula:

\[ \text{adjusted score} = (\text{number correct}) - \frac{1}{4} (\text{number attempted and missed}). \]

The data from these pre- and posttests have been graphed by individuals' scores and charted to compare the mean,
mode, median, range, and standard deviation. These appear on the following pages.
TEST SESSION #1

SCORE COMPARISONS ON PRE- AND POSTTESTS

<table>
<thead>
<tr>
<th>Score Range</th>
<th>Pre(---)</th>
<th>Post(----)</th>
<th>Increase</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-2</td>
<td>11.851</td>
<td>14.905</td>
<td>3.046</td>
</tr>
<tr>
<td>3-4</td>
<td>13 &amp; 14</td>
<td>12 &amp; 15</td>
<td>0.000</td>
</tr>
<tr>
<td>5-6</td>
<td>11.500</td>
<td>15.000</td>
<td>3.500</td>
</tr>
<tr>
<td>7-8</td>
<td>(3-20)</td>
<td>(8-24)</td>
<td>-1.000</td>
</tr>
<tr>
<td>9-10</td>
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<td>29-30</td>
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N = 21

Mean
Mode
Median
Range
Standard Deviation
TEST SESSION #2

SCORE COMPARISONS ON PRE- AND POSTTESTS

N = 17

<table>
<thead>
<tr>
<th></th>
<th>Pre (---)</th>
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</thead>
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<tr>
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<td>12.408</td>
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<tr>
<td>Mode</td>
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<td>24.000</td>
<td>16.000</td>
</tr>
<tr>
<td>Median</td>
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<td>23.000</td>
<td>14.000</td>
</tr>
<tr>
<td>Range</td>
<td>(3-18)</td>
<td>(16-30)</td>
<td>-1.000</td>
</tr>
<tr>
<td>Standard Deviation</td>
<td>3.724</td>
<td>4.337</td>
<td>0.613</td>
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</table>
Statistical Analyses

The analyses were based on the assumptions that TS#1 and TS#2 students were normally distributed. Hence, the Student's t-Test for matched groups was used for evaluating the difference of the means for the pre- and post-tests. The hypothesis tested was "There was no significant improvement in scores from the pre- to the posttests."

The t-value for TS#1 rejects the null hypothesis at the 99% confidence level, while the t-value for TS#2 rejects this same hypothesis at the 99.9% confidence level. There is a significant difference between the means of the adjusted scores. The t-value for TS#1 was significantly lower than for TS#2 which suggests the success of program changes made in TS#2.

The aim of this section was to reject the null hypothesis, thereby showing a significant improvement in the students' ability to answer questions similar to those on the GRE Mathematics Section. The t-score was used and the complete results appear on the following page.
## STUDENT'S $t$-TEST VALUES FOR MATCHED GROUPS (PAIRS OF TESTS)

<table>
<thead>
<tr>
<th>Group</th>
<th>Pairing</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>Degrees of Freedom</th>
<th>$t$-Value</th>
<th>Confidence Level</th>
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<tbody>
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<td>Pre-</td>
<td>11.857</td>
<td>5.102</td>
<td>20</td>
<td>3.444</td>
<td>99%</td>
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<tr>
<td></td>
<td>Post-</td>
<td>14.905</td>
<td>4.300</td>
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<tr>
<td>TS#2</td>
<td>Pre-</td>
<td>10.647</td>
<td>3.724</td>
<td>16</td>
<td>10.059</td>
<td>99.9%</td>
</tr>
<tr>
<td></td>
<td>Post-</td>
<td>23.059</td>
<td>4.337</td>
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</tr>
</tbody>
</table>
Having considered the accomplishments of each session separately, it is worthwhile in a final overview, to compare the results for both.

It is evident that the achievement of students in TS#2 significantly exceeded that of those in TS#1 (compare tables on pages 32 to tables on pages 33). This change can best be understood in terms of first, the contrasting characteristics of each group, and second, the changes in teaching format introduced in TS#2.

TS#1 students were only moderately motivated to succeed. They attended only an average of 74% of the meetings. They did little extra work, and they were not particularly helpful to fellow students.

By contrast, TS#2 students were much more diligent and dedicated to the task of improving their scores. TS#2 participants attended an average of 92% of the meetings. They put in a great deal of extra study time on their own, both at the LRC and at home. Many even requested additional self-instructional material. The TS#2 group also showed a greater concern for other students by being extremely helpful in explaining concepts to fellow students.

But differences in student approach were not the only factors. General methods of instruction and the materials used were improved from TS#1 to TS#2 based on a combination of greater experience and adaptation to student
feedback. In addition, two extra meetings were added to TS#2, giving the instructor more time to present practice problems and insuře the student's greater understanding. (The graph on the following page clearly shows that the attendance at meetings 9 and 10 had a significant effect on posttest scores.) TS#2 students were also given an extra week of time because of Easter vacation and this time was used wisely by most of the students.

All of the above factors should be taken into account in explaining the marked difference in the improvement of TS#2 over TS#1. In adjusted scores TS#2 improved 12.408 points to TS#1's 3.046 points. In other words, TS#2 scores improved over 75% more than the improvement of TS#1.
DIFFERENCE IN PRE- AND POSTTEST SCORES

COMPARED WITH NUMBER OF MEETINGS ATTENDED

(TS#1 and TS#2)

TS#1 average participant attended 74% of meetings.

TS#2 average participant attended 92% of meetings.
CHAPTER VII
SUMMARY

The author has documented the need for this project and study. He has given a brief history of how the GRE Prep Sessions evolved from a simple test anxiety session in the CSUN Counseling Center to the structured, yet informal GRE Prep Sessions of today.

The content of the meetings have been outlined and all supplementary material has been included. Reviewing subject matter to insure competence in basic mathematics skills and relieving test anxiety by familiarizing students with the format of the GRE, were the objectives in attempting to prepare students for the examination. It should be noted that the instructor was not primarily teaching to the GRE Mathematics Section. As stated in the Educational Testing Service Bulletin sent to each student:

Special study for the verbal sections of the Aptitude Test is not likely to be effective and is not recommended. However, if you have not used mathematics for some time, review of basic algebra and geometry would be worthwhile. No advanced mathematics is required.

Accordingly, the author aimed at giving academic instruction in these basic skills through the medium of review and practice problems.
The relieving of anxiety and building of confidence was of even more importance. Following the trend in many colleges today, a large number of the students were returning to school after an absence of many years. Even those that had attended school recently, had not been required to take major examinations in most of their classes. Moreover, students competent in other fields, would freeze when confronted with a major examination involving mathematics. Many students commented that they were "terrified" of the Mathematics Section of the GRE. The instructor's task in this area was well defined. First, students needed to have their unrealistic fears eliminated. This was accomplished by carefully going over the format of the examination and rehearsing actual test conditions. The students slowly became accustomed to working under time pressure. Second, students needed an increase of confidence. This was instilled gradually, meeting by meeting, by positive feedback and adequate practice problems. Students had a foundation to rely on--knowledge and self-assurance. Evaluations of students' progress given at the end of each meeting became increasingly positive, giving the instructor a great deal of personal satisfaction. This reinforced the growing enthusiasm of the instructor and the students.

In addition to verbal feedback, student questionnaires provided valuable information regarding the student, with emphasis on mathematics background. These
questionnaires, completed in the first and last meetings, along with academic pre- and posttests, were used to evaluate the sessions. Success in relieving anxiety was also determined from the questionnaires.

The data from these two test sessions has been analyzed and interpreted. From the author's viewpoint, the final outcome was easily predictable based on the step-by-step progress in attitude and skills; the sessions were successful in relieving test anxiety and preparing students to solve questions similar to those on the Mathematics Section of the GRE.

Finally, in making an indepth study, some questions for further investigation have arisen. One obvious question is, "What were the final GRE scores of the prep session participants and how would they compare to those of other students?" The author could not approach this question as the desirable information was in closed files and not obtainable. Some students did respond with actual scores, but not in a sufficient number to be significant.

Hopefully, this, and other relevant questions will be explored and answered in the near future. With or without the final GRE scores of these students, it has been shown that this program has fulfilled the needs of an appreciable group of CSUN students. The success of this project suggests that similar preparation programs might well be undertaken for many of the other graduate admissions tests.
REFERENCES


Campbell, Joel T., Effects of Repeating on Test Scores of the GRE, GRE Special Report #672-1, April 1967, 30 pp. (Educational Testing Service).


Lannholm, Gerald V., Cooperative Studies of Predicting Graduate School Success, GRE SR#68-3, August 1968 (Educational Testing Service).


Lannholm, Gerald V., The Use of GRE Scores and Other Factors in Graduate School Admissions, GRE SR#68-4, October 1968 (Educational Testing Service).

APPENDICES
APPENDIX A

LETTER TO PARTICIPANTS
Dear Student:

The first meeting of the preparation sessions for the _________ will be held Monday evening, January 27, at 7:30 P.M. in Sierra South, Room 105.

In advance of the first sessions, you'd do well to obtain a copy of:

Gruber & Gruber: Graduate Record Examination
Gruber & Willdorf: The Law School Admission Test
Gruber: The Medical College Admission Test,
since this will be the basic book used in the prep sessions for the exam.

We look forward to meeting you Monday evening, January 27.

Cordially,

Bill Huling, Psychologist, Counseling Center
Jerry Bobrow, Mathematics Teacher, Learning Resource Center
APPENDIX B

PRE-QUESTIONNAIRE
QUESTIONNAIRE

1. How did you learn about the GRE Prep Sessions?

2. Are you presently attending college? _______
   If not, how long have you been out of school? _______

3. Your age is _______

4. Your sex is _______

5. Your major subject is _______

6. Highest degree earned _______

7. Have you ever had a class in or that covered the following material: (If yes, how long ago?)
   Basic Math _______
   Algebra _______
   Plane Geometry _______
   Analytic Geometry _______
   Graph or Chart Reading and Interpretation _______
   Statistics _______
   Trigonometry _______
   Calculus or Higher Math _______

8. When will you be taking the test? _______

9. Have you taken the GRE before? _______
   If yes, when _______

10. Have you taken any tests similar to the GRE? _______

11. Have you been to any other GRE Prep Sessions? _______
    At CSUN? _______
<table>
<thead>
<tr>
<th>12. What do you hope to gain from the Prep Sessions?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td>13. Briefly describe any feelings, positive or negative about the actual exam.</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>
APPENDIX C

LIST OF USEFUL MATERIALS AVAILABLE AT LRC
# LIST OF USEFUL MATERIALS AVAILABLE AT THE LEARNING RESOURCE CENTER

Autotutor Program - **First Year Algebra** (6 Cassettes)

Data Sheets - **Modern Algebra, Elementary Algebra, College Algebra**

Five Books - **Programmed Beginning Algebra** by T. Drooyan

One Book - **Fundamentals of Elementary Algebra** by Michael Eraut

One Book - **Fundamentals of Intermediate Algebra** by Michael Eraut

Cassettes and Workbook - **Algebra (Beginning)** by Allan Bray

Mast Program - **Algebra Refresher Course** (4 Cartridges)

Five Books - **First Year Algebra** by Daniel Murphy

Kit & Record Books - **Algebra Skills Kit** (SRA) by Chas. M. Proctor

One Book - **Solving Math Word Problems** by Harold Schneider

Autotutor Program - **Fractions, Decimals, Percentages, Ration and Proportion** (4 Cassettes)

One Book - **Basic Mathematics** (Programmed) by Daniel Bobrow

One Book - **Quick Arithmetic** (Programmed) by Robert Carman

One Book - **Fundamentals of Arithmetic** by Michael Eraut

One Book - **Programmed Business Math Book 1** by Harry Huffman

One Book - **Basic Mathematics** by Kruglark and Moore

One Book - **Math Shortcuts** by Flora Locke

One Book - **The Universal Encyclopedia of Math** by James Newman

One Book - **Arithmetic of the Whole Numbers** (Programmed) by James Smith
One Book - Practice Book for Basic Math Concepts by F. Lynwood Wren

Data Sheets - Geometry by Data Guide

Slide Program - Plane Geometry with Cassette Adopted by Jerry Bobrow

Booklet - Charts and Graphs Review from ARCO Manual

Booklet - Arithmetic Review from ARCO Manual
APPENDIX D

OUTLINE OF PREP SESSION MEETINGS
Threshold Programs - GRE/LSAT/MCAT

PREP SESSION MEETINGS

I. INTRODUCTION
   A. Overview of Sessions
   B. Test Strategies
   C. Simulation Test (40 minutes)
   D. LRC Assignment: Arithmetic Review Self-Test with Answers

II. THE BASICS - PART 1
   A. Math Symbols - The Language of the Math Section
   B. Some Important Techniques
   C. Arithmetic Review
   D. LRC Assignment: Algebra Review Self-Test with Answers

III. THE BASICS - PART 2
   A. Algebra Review
   B. Geometry Filmstrip (Important Review!)
   C. LRC Assignment: Geometry Review Self-Test with Answers
   D. LRC Assignment: Graphs and Charts Page 400 (Read)

IV. THE BASICS - PART 3
   A. Graph Reading
   B. Practice Problems
   C. Analytic Geometry
   D. LRC Assignment: Graph and Chart Review Self-Test with Answers

V. THE ACTUAL TEST
   A. Test-taking Techniques
   B. Short-cuts
   C. Test Anxiety
   D. Practice Problems Explained Thoroughly
   E. LRC Assignment: Practice Test from Manual

VI. THE ACTUAL TEST
   A. Review of Problems from Practice Test
   B. What to Look for in the Problems
   C. More Practice Problems Explained Thoroughly
   D. LRC Assignment: Practice Test from Manual

VII. TEST ANXIETY
   A. The Key to Doing Your Best
   B. Some Do's and Don'ts
   C. Simulation Test (40 minutes)
D. Simulation Test (40 minutes)
E. LRC Assignment: General Review

VIII. REVIEW
A. Techniques Reviewed
B. Some Things Not to Forget
C. Test Taking Tactics
D. LRC Assignment: Light Overall Review and then RELAX!!!
APPENDIX E

FORMAT OF RECENT GRE
<table>
<thead>
<tr>
<th>Section</th>
<th>Number of Questions</th>
<th>Number of Minutes</th>
</tr>
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<tbody>
<tr>
<td>Section 1:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>VERBAL ABILITY (ANTONYMS, ANALOGIES, SENTENCE COMPLETIONS)</td>
<td>60</td>
<td>25</td>
</tr>
<tr>
<td>Section 2:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>READING COMPREHENSION (6 PASSAGES)</td>
<td>40</td>
<td>50</td>
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<td>Section 3:</td>
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<tr>
<td>MATH ABILITY</td>
<td>55</td>
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<td>Section 4:</td>
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<tr>
<td>EITHER</td>
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<td></td>
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<td>MATH ABILITY</td>
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<td>30</td>
</tr>
<tr>
<td>OR</td>
<td></td>
<td></td>
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<tr>
<td>READING COMPREHENSION (2 PASSAGES)</td>
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</table>

TOTAL MINUTES FOR GRE APTITUDE TEST = 180 (3 hours)
APPENDIX F

PRE- AND POSTTEST ANSWER SHEET
GRE MATH SAMPLE TEST

This Sample Test is very much like the actual Graduate Record Examination Aptitude Test in Quantitative Ability. However, this Sample Test is not a copy of the actual test. The actual test is copyrighted and may not be duplicated. The primary purpose of your taking this Sample Test is to help you to diagnose your Math weaknesses so that you can proceed immediately to eliminate those weaknesses.

Directions: Each of the problems in this test is followed by five alternatives lettered A through E. Solve each problem and then choose the correct answer. Blacken the corresponding space on your answer sheet. Note that diagrams are not necessarily drawn to scale.
<table>
<thead>
<tr>
<th>Section 1</th>
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<td>20</td>
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APPENDIX G
PRETESTS A AND D
(SAMPLE TESTS WITH ANSWERS)
SAMPLE TEST A

SECTION I

Time: 40 Minutes

1. Two dozen apples costs $2.00 and, on the average, there are 3 apples in a pound. How much should 100 pounds of apples cost?
   (A) $5.00     (D) $25.00
   (B) $12.50    (E) $40.00
   (C) $18.00

2. Solve for x: \(x^2 + 7 = x(x + 7) + 1\)
   (A) \(7/6\)     (D) 0
   (B) \(6/7\)     (E) \(3/4\)
   (C) 1

3. Find the largest number.
   (A) \(7/6\)     (D) \(\sqrt{2}\)
   (B) \(9/5\)     (E) \(1.51\)
   (C) \(\sqrt{3}\)

4. If a teacher failed 18% of his students, how many passed out of a class of 50?
   (A) 41     (D) 34
   (B) 43     (E) 39
   (C) 35

5. What is the value of the expression \(\frac{b^2 + b^3}{b - 1}\) if \(b^3 = 27\)?
   (A) 9     (D) 24
   (B) 13     (E) 36
   (C) 18

6. How many integers less than 50 exist such that their square root is rational?
   (A) none     (D) 7
   (B) 3     (E) 8
   (C) 5

7. A car was initially priced at $3,000. The price was reduced 20% and then raised 10%. What was the total reduction in price?
   (A) $125     (D) $540
   (B) $270     (E) $840
   (C) $360
8. Given that \( \frac{a}{2} = b + \frac{c}{2} \) and \( b = 3c \) and \( c = \frac{1}{2} \) find \( a \).
   
   (A) 1 1/2  
   (B) 2  
   (C) 2 3/4  
   (D) 3  
   (E) 3 1/2

9. In the figure above, parallelogram ABCD is composed of four congruent triangles. If BE is 3 and CE is 4 what is the perimeter of the entire figure?
   
   (A) 24  
   (B) 20  
   (C) 16  
   (D) 28  
   (E) cannot be determined from the information given

10. On the graph above what is the difference between the area of square ABCD and triangle EFG?
   
   (A) 4  
   (B) 26  
   (C) 31  
   (D) 18  
   (E) 29

11. A worker had to pay taxes that amounted to 9% of his earnings. He was left with $1820. How much did he earn?
   
   (A) $1960  
   (B) $2000  
   (C) $2080  
   (D) $2200  
   (E) $2750
12. On the graph above, find the coordinates of point A if we know that CB is 2 and angle ACB is 45° and angle ABC is 90°.

(A) (2,0)  
(B) (2,2)  
(C) (2,3)  
(D) (1,1)  
(E) cannot be determined from the given information

13. Which of the following figures could not be drawn without lifting the pencil off the paper or retracing a line?

(A)  
(B)  
(C)  
(D)  
(E)
14. Which of the following expressions is equivalent to 8 times the product of some number and twice that number?

(A) $8x^2$  
(B) $8x + 2$  
(C) $2x^2 + 8$

15. Consider the expression $\frac{1}{a} + \frac{1}{a - 1} + \frac{1}{a + 1}$

For how many values of $a$ is this expression meaningless?

(A) 3  
(B) 2  
(C) 1  
(D) none  
(E) infinitely many

Questions 16-21 refer to the following graphs.

Employee benefits as a per cent of payroll
16. How many cents per payroll hour come under the heading "Pension Plan, Life & Health Insurance Payments, etc."?
   (A) 15.4  (D) 46.1
   (B) 24.7  (E) 56.7
   (C) 30.0

17. Approximately what fraction of companies studied have employee benefits as 16.0%-19.9% of the payroll?
   (A) 1/2  (D) 1/25
   (B) 1/12 (E) 3/16
   (C) 2/11

18. How many companies studied paid 40% or more of the payroll as employee benefits?
   (A) 24  (D) 120
   (B) 46  (E) 142
   (C) 57

19. How many degrees are there in the sector of the circle graph representing "Profit-Sharing Payments, Other Bonuses"?
   (A) 7.8  (D) 28.1
   (B) 11.6 (E) 35.0
   (C) 24.5

20. In how many ways can you add two sectors of the circle graph and have the sum equal to more than half the circle?
   (A) 0  (D) 3
   (B) 1  (E) 4
   (C) 2

21. How many more of the companies studied have employee benefits as 24.0%-27.9% of the payroll than have the benefits as 16.0%-19.9% of the payroll?
   (A) 92  (D) 75
   (B) 180 (E) 210
   (C) 35
22. Find the value of $1 - \frac{1}{2} + \frac{1}{4} - \frac{1}{8} + \frac{1}{16} - \frac{1}{32}$

(A) $\frac{21}{32}$  
(B) $\frac{10}{41}$  
(C) $\frac{2}{3}$

23. Printing a pamphlet costs 1¢ for 10 words plus 25¢ for each page. How much would a pamphlet cost which had 4200 words and 500 words on each page?

(A) $4.00$  
(B) $4.45$  
(C) $23.60$  
(D) $6.45$  
(E) $8.50$

24. In the figure above, triangle CDF is equilateral, and AE bisects angle DCF. If angle B is 90° how many degrees are there in angle A?

(A) 30°  
(B) 60°  
(C) 45°  
(D) 22\,1/2°  
(E) 70°
Find an expression for the shaded area shown above.

(A) \((r + \pi)^2\)  
(B) \(r^2 - 2\pi\)  
(C) \(2r^2 - \pi r^2\)  
(D) \(r^2(4 - \pi)\)  
(E) \(4r^2 - \pi\)

26. Convert the fraction \(\frac{5}{6}\) into a repeating decimal.

(A) \(0.76666\ldots\)  
(B) \(0.8333\ldots\)  
(C) \(0.8383\ldots\)  
(D) \(0.87500\ldots\)  
(E) \(0.9111\ldots\)

27. A survey of 50 people showed that 20 could write only with their left hand and ten could write with either hand. How many could write with their right hand?

(A) 30  
(B) 20  
(C) 25  
(D) 10  
(E) 40

28. What is the average of the terms \(y, y + 1, y - 1, 2y\)?

(A) \(\frac{4}{5}(y + 1)\)  
(B) \(y + 5\)  
(C) \(y\)  
(D) \(\frac{5}{4}y\)  
(E) \(1 \frac{1}{4}\)

29. A rectangle is 5 units longer than it is wide. Find its width if its perimeter is 60.

(A) 10  
(B) 12 \(1/2\)  
(C) 17 \(1/2\)  
(D) 20  
(E) 25
30. The mileage on a car was 3740 when the gas tank was one-half full. When the tank was empty the mileage was 3890. If the car averages 15 miles to the gallon, how much can the gas tank hold?

(A) 20 gallons  (D) 10 gallons
(B) 15 gallons  (E) 17 gallons
(C) 22 1/2 gallons
<table>
<thead>
<tr>
<th>ANSWERS TO PRETEST A</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. D</td>
<td>26. B</td>
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<tr>
<td>2. B</td>
<td>27. A</td>
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<td>4. A</td>
<td>29. B</td>
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<tr>
<td>5. C</td>
<td>30. A</td>
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<td>6. E</td>
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<td>7. C</td>
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<td>8. E</td>
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<td>23. D</td>
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<td>24. B</td>
<td></td>
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<tr>
<td>25. D</td>
<td></td>
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</tbody>
</table>
SAMPLE TEST D

SECTION 1

Time: 40 minutes

1. A certain car gets 20 miles to the gallon. If gasoline costs between 30¢ and 40¢ per gallon, what is the minimum distance the car can travel on $2.40 worth of gasoline?

(A) 80 miles   (D) 140 miles
(B) 100 miles  (E) 160 miles
(C) 120 miles

2. Evaluate $x^2+2x^2-3x$, given that $x = 3$.

(A) 6    (D) 9
(B) 7    (E) 10
(C) 8

3. Which fraction is greater than 1/4?

(A) 2/9   (D) 17/72
(B) 5/18  (E) 35/144
(C) 8/36

4. If 1 out of every 200 people who play a certain promotional game win a prize, what percent of people lose?

(A) 90.0%   (D) 99.0%
(B) 95.5%   (E) 99.5%
(C) 98.5%

5. Given that $x^7+5x = 15+x^7$, what is $x$ equal to?

(A) 0    (D) 3
(B) 1    (E) 4
(C) 2

6. The price of a $500 camera is reduced by 10%. That price is again reduced by 20%. What, in dollars, is the total discount?

(A) $100  (D) $130
(B) $110  (E) $140
(C) $120
7. Given that \( x \div z = y \) and \( x, y, z \) are all real numbers, what can be said about \( x \times z \)?

(A) can be anything \hspace{1cm} (D) equal to \( y \)
(B) must be zero \hspace{1cm} (E) equal to \( z \)
(C) equal to \( x \)

8. \( a \times b = 30 \) and \( 2b = 4 \). Then \( a = \)

(A) 2 \hspace{1cm} (D) 5
(B) 3 \hspace{1cm} (E) 6
(C) 4

9. Each unit on the \( y \) axis in the diagram above represents 3 inches, while every unit on the \( x \) axis represents 2 inches. The sum of the areas of two of the figures drawn is 120 square inches. Which are the two figures?

(A) I, II \hspace{1cm} (D) II, III
(B) I, III \hspace{1cm} (E) II, IV
(C) I, IV

10.
Points P, Z, C, E, F are the centers of the five congruent circles drawn above. Q, D, B are points on the circles and on the lines of centers (dotted lines). If line QP is part of a parallelogram, which of the following is another part of it?

(A) BC  (D) BD
(B) AC  (E) DQ
(C) AD

11.

What are the coordinates of point P?

(A) (5, 5)  (D) (-5, -5)
(B) (3, 3)  (E) (3, 5)
(C) (-3, -3)

12. Beads are strung onto a necklace in this order: red, white, green. A design which begins on red and ends on white could be composed of the following number of beads:

   I. 17
   II. 29
   III. 35

(A) I only  (D) I and III only
(B) III only  (E) I, II and III
(C) II and III only

13. Twice \( y \) is six less than three times \( x \). Which is the appropriate algebraic expression for this fact?

\[ 2y = 3x - 6 \]
14. The area of the rectangle shown above is 50. Find the area of the shaded portion.

(A) 20
(B) 25
(C) 30
(D) 32½
(E) 18⅔

15. Which of the following expressions cannot give an even result?

I. the product of two even numbers
II. the product of an even and an odd number
III. the product of two odd numbers

(A) I only
(B) II only
(C) III only
(D) I and II only
(E) I and III only

16. A school has S students. Q students serve on squads while T students are on teams. B students are on both a team and a squad. How many students are not on a squad nor on a team?

(A) S + Q + T + B
(B) S - Q - T - B
(C) S - Q - T + B
(D) S + Q + T - B
(E) S - Q + T + B
17. HEIGHT  48 in.  54 in.  60 in.  66 in.  72 in.
WEIGHT  100 lb.  120 lb.  140 lb.  160 lb.  180 lb.

Using a table shown above, what would you expect to be the weight of a person who is 75 inches tall?

(A) 185  (B) 190  (C) 200  (D) 205  (E) 220

18. Find the value of \( \sqrt{b^2 + 16 - \sqrt{b + 6}} \) if \( b = 3 \).

(A) 2 \( \sqrt{2} \)  (B) 2  (C) 4  (D) 0  (E) 1

19.

The figure above shows the graph of a relation between \( x \) and \( y \). For each value of \( x \) between \( a \) and \( b \) there is (are):

(A) no values of \( y \)  (B) exactly one value of \( y \)  (C) at least 2 values of \( y \)
(D) exactly 2 values of \( y \)  (E) 3 or more values of \( y \)

20.
The area of triangle AOB shown above is 6. If the coordinates of A are (3,0) what are the coordinates of B?

(A) (0,2)  (B) (0,3)  (C) (0,4)  (D) (0,6)  (E) (0,8)

Questions 21-24 are based on this chart.

The federal government dollar

21. What percent of the federal budget goes toward education?
   (A) 9%  (B) 10%  (C) 11%  (D) 12%  (E) 13%

22. The pie graphs represent a budget of about $150 billion dollars. How much of the budget was spent on social insurance?
   (A) $10 billion dollars  (B) $20 billion dollars  (C) $30 billion dollars  (D) $40 billion dollars  (E) $50 billion dollars

23. How much more money was spent on veterans' affairs than on international relations? (The budget = $150 billion dollars)
24. The revenue from excise taxes could pay for which parts of the government's budget?

(A) veterans' affairs and interest on loans
(B) national defense and education
(C) social insurance and veterans
(D) national defense and education
(E) international relations and interest on loans

25. Which of the following is the circumference of a circle whose radius is an integer?

(A) 3
(B) $3\pi$
(C) 4
(D) $4\pi$
(E) 5

26. Angle AED, shown above is $90^\circ$. Angle BED is $40^\circ$, angle AEC is $75^\circ$. What is the measure of angle BEC?

(A) $10^\circ$
(B) $15^\circ$
(C) $20^\circ$
(D) $25^\circ$
(E) $30^\circ$
27.

Line BC divides triangle ADE into sections, one of them an isosceles triangle (AB = AC). Angle B, one of the base angles, is equal to 75°. What is the sum of the measures of angles D and E?

(A) 100°  (D) 175°
(B) 125°  (E) 200°
(C) 150°

28. If \[-\frac{1}{P + 1} = \frac{x}{2}\]

(A) \(-\frac{1}{2}\)  (D) \(-\frac{1}{4}\)
(B) \(\frac{1}{2}\)  (E) \(-\frac{1}{3}\)
(C) 2

29. If \(p = \sqrt{15.44}\), which of the following describes \(p\)?

(A) 3.50 < \(p\) < 4.00  (D) 5.00 < \(p\) < 5.50
(B) 4.00 < \(p\) < 4.50  (E) 5.50 < \(p\) < 6.00
(C) 4.50 < \(p\) < 5.00

30.

In the figure above, AB is perpendicular to BD. How many degrees are there in angle ABC?
<p>| | |</p>
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<td>(A)</td>
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<td>(D)</td>
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<td>(E)</td>
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## ANSWERS TO PRETEST D

1. C  
2. A  
3. B  
4. E  
5. D  
6. E  
7. C  
8. B  
9. D  
10. A  
11. D  
12. E  
13. E  
14. B  
15. C  
16. C  
17. B  
18. B  
19. B  
20. C  
21. C  
22. C  
23. A  
24. E  
25. D  
26. D  
27. C  
28. A  
29. A  
30. B
APPENDIX H

SELF-EVALUATION FORM
SELF-EVALUATION FORM

Name

Date

Test A B C D (Circle one)

Please give yourself a rating in each of the five areas.

Ratings:  1 - Excellent  
2 - Good  
3 - Average  
4 - Fair  
5 - Poor

<table>
<thead>
<tr>
<th>AREAS</th>
<th>RATING</th>
<th>RIGHT</th>
<th>WRONG</th>
<th>TOTAL</th>
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<td>Graphs &amp; Charts</td>
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<td><strong>AVERAGE</strong></td>
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</table>
APPENDIX I

SYMBOLS IN MATHEMATICS
"SYMBOLS IN MATH"

1. $x^m$, $2^3$, $2^{-2}$, $2^0 = 1$, $(\text{-}2)^2$  
   **POWERS AND EXPONENTS**

2. $\sqrt{4}$, $\sqrt[3]{8}$, $2\sqrt{2}$, $4^{\frac{1}{2}}$  
   **ROOTS AND RADICALS**

3. $x$, $\cdot$, $(2)(3)$, $3(3)$, $ab$, $2b$  
   **MULTIPLICATION**

4. $\div$, $2/6$, $\frac{30}{10}$  
   **DIVISION, FRACTIONS**

5. $1:3$  
   **RATIO**

6. $\%$, $25\% = 25/100 = 1/4$  
   **PERCENT**

7. $+$  
   **ADDITION**

8. $-$  
   **SUBTRACTION**

9. $( )$  
   **PARENTHESES**

10. $[ ]$  
    **BRACKETS**

11. $\{ \}$  
    **BRACES**

12. $=, \equiv, \neq, \approx, \sim, \cong$  
    **EQUALS, CONGRUENCE**

13. $>$  
    **GREATER THAN**

14. $<$  
    **LESS THAN**

15. $\geq$, $\geq$, $\leq$  
    **GREATER THAN OR EQUAL TO**

16. $\leq$, $\leq$, $\approx$  
    **LESS THAN OR EQUAL TO**

17. $\pm$, $\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{3}$  
    **NOT ...**

18. $|x|$, $|3| = 3$  
    **ABSOLUTE VALUE**

19. $\begin{vmatrix} 2 & 1 \\ 4 & 3 \end{vmatrix} = 2(3) - 4(1) = 2$  
    **DETERMINANTS**

20. $N!$, $4! = 4 \times 3 \times 2 \times 1$, $0! = 1$  
    **FACTORIALS**

21. $\angle 1$, $\angle A$, $\angle BAC$  
    **ANGLE**

22. $\triangle ABC$, $\Delta$, $\triangle's$  
    **TRIANGLE**

23. $\overline{AB}$, $\overline{AB}$  
    **LINE SEGMENT**

24. $\overrightarrow{AB}$, $\overrightarrow{AB}$  
    **LINE**
25. \( \overline{AB} \)
26. \( \overline{AB} \)
27. \( \perp \), \( \overline{AB} \parallel \overline{BC} \)
28. \( \parallel \), \( \overline{AB} \parallel \overline{DC} \)
29. \( \perp \), Rt. \( \perp \), \( \perp \) Rt.
30. \((x, y), (2, 3)\)
31. \( f(x), g(x) \)
32. \( ', 30' \)
33. \( "', 30" \)
34. \( °, 30° \)
35. \( \circ \)
36. \( \square \overline{ABCD} \)
37. \( \square \overline{ABCD} \)
38. \( \square \overline{ABCD} \)
39. \( \infty \)
40. \( \sqrt{2} \approx 1.4, \sqrt{3} \approx 1.7, \pi \approx 3.14 \) or \( 22/7 \)
APPENDIX J

DIAGNOSTIC SELF-TEST IN ARITHMETIC

(WITH ANSWERS)
DIAGNOSTIC SELF-TEST......ARITHMETIC GRE

GRE REVIEW SECTION

1. Reduce 12/30
2. Change 16/3 to mixed numbers
3. \( \frac{3}{7} \times \frac{2}{5} = \)
4. \( \frac{3}{14} \times \frac{49}{6} = \)
5. \( \frac{2}{3} \div 1/4 = \)
6. \( \frac{3}{5} \div 1/7 = \)
7. \( \frac{2}{3} - 1/6 = \)
8. \( \frac{2}{3} \div \frac{5}{7} = \)
9. \( 3 \frac{1}{3} \times 1/10 = \)
10. Change .42 to a fraction
11. Add 10.9 + 15.73 + 22.001 =
12. Multiply: 3.1 x 2.7 =
13. Subtract: 17.19 - 8.4 =
14. Divide: 51 - 1.2 =
15. Change 4/25 to percent
16. 15 is 25% of what number?
17. What number is 15% of 30?
18. Multiply 4^5 x 4^3 =
19. Divide: 6^5 \div 6^2 =
20. Simplify: \( \sqrt{32} = \)
21. Add: \( \sqrt{50} + \sqrt{2} = \)
22. Factor 200 into primes
23. Is 99 prime?

CHECK YOUR ANSWER WITH THE KEY ON THE BACK...............
KEY TO THE DIAGNOSTIC SELF-TEST

1. 2/5
2. 5 1/3
3. 6/35
4. 7/4 or 1 3/4
5. 8/3 or 2 2/3
6. 26/35
7. 1/2
8. 14/15
9. 1/3
10. 42/100 or 21/50
11. 48.631
12. 8.37
13. 8.79
14. 42.5
15. 16%
16. 60
17. 4.5
18. 4^8
19. 6^3
20. 4√2
21. 6√2
22. 2 x 2 x 2 x 5 x 5 or 2^3 x 5^2
23. No
APPENDIX K

DIAGNOSTIC SELF-TEST IN ALGEBRA

(WITH ANSWERS)
<table>
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<tr>
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<th>Review Section</th>
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</thead>
<tbody>
<tr>
<td>2-2</td>
<td>1) (-5 \div 8 = )</td>
</tr>
<tr>
<td>2-2</td>
<td>2) (-6 - 3 = )</td>
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<td>2-2</td>
<td>3) (-2 - (-4) = )</td>
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<td>2-3</td>
<td>4) ((-2) \times (-5) = )</td>
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<tr>
<td>2-4</td>
<td>5) (-12 \div 6 = )</td>
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<tr>
<td>2-5</td>
<td>6) ((-2)^5 = )</td>
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<td>2-7</td>
<td>7) Simplify: (x - (-x + 1) = )</td>
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<tr>
<td>2-7</td>
<td>8) Simplify: (2x + x - 7 + 4 = )</td>
</tr>
<tr>
<td>2-8</td>
<td>9) Change to a single fraction: (2/x + 3/y )</td>
</tr>
<tr>
<td>2-9</td>
<td>10) ((2x)(3x^2) = )</td>
</tr>
<tr>
<td>2-9</td>
<td>11) ((x + 2)(x + 3) = )</td>
</tr>
<tr>
<td>2-10</td>
<td>12) Divide (21a^2b^3 ) by (14a^2b^5 )</td>
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<tr>
<td>2-12</td>
<td>13) (\frac{32a^2b^2}{8a^4b^3} ) If (a = 4 ) &amp; (b = -2 )</td>
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<tr>
<td>2-15</td>
<td>14) Factor: ((4x^2 + 2x))</td>
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<td>2-16</td>
<td>15) Factor: ((4n^2 - 9))</td>
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<tr>
<td>2-17</td>
<td>16) Factor: (x^2 + 3x + 2)</td>
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<tr>
<td>2-22</td>
<td>17) Solve: (3x + 2 = 11) (x = )</td>
</tr>
<tr>
<td>2-22</td>
<td>18) Solve: (10x + 17 = 3x - 4) (x = )</td>
</tr>
<tr>
<td>2-23</td>
<td>19) Solve: (x^2 - 25 = 0) (x = )</td>
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<tr>
<td>2-23</td>
<td>20) Solve: (y^2 = 5y - 4) (y = )</td>
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<tr>
<td>2-24</td>
<td>21) Solve for (x): (2x + 3y = 6) (x = )</td>
</tr>
<tr>
<td>2-25</td>
<td>22) Find (y), if: (x + 3 = 5) and (xy + 9/x = 10)</td>
</tr>
</tbody>
</table>
2-28 23) What is to 12 as 3 is to 4?

2-28 24) If 3 pounds of apples cost 57¢, how much does 10 pounds of apples cost?

2-31 25) If a boy flew from New York to Chicago, a distance of 1600 miles, at a rate of 400 miles per hour and then a train took him home at a rate of 80 miles per hour. How long did the entire trip take?

2-32 26) Bill can do a job alone in 5 hours. Bob can do the same job in 4 hours. If they work together, how long will the job take?

2-34 27) Average: 10, 5, 110, 130, and 65

2-38 28) For what values of x is $3x > x + 2$ a true statement?

2-40 29) Which is greater, $\frac{1}{4}$ or $\frac{7}{27}$?
ANSWERS TO GRE ALGEBRA REVIEW DIAGNOSTIC TEST

1. 3
2. -9
3. 2
4. 10
5. -2
6. -32
7. 2x - 1
8. 3x - 3 or 3(x - 1)
9. \( \frac{3x + 2y}{xy} \)
10. 6x^3
11. x^2 + 5x + 6
12. \( \frac{3}{2b^2} \)
13. -1/8
14. 2x(2x + 1)
15. (2m - 3)(2m + 3)
16. (x + 2)(x + 1)
17. x = 3
18. x = -3
19. x = +5, -5
20. y = 1.4
21. \( x = \frac{6 - 3y}{2} \) or \( 3 - \frac{3y}{2} \)
22. y = 2 3/4 or 11/4
23. x = 9
24. x = $1.90
25. 24 hours
26. 2 2/9 hours
27. Average is 64
28. x > 1
29. 7/27
APPENDIX L

DIAGNOSTIC SELF-TEST IN PLANE GEOMETRY

(WITH ANSWERS)
1. Which of the following name the same angle?
   A. $\angle A$, $\angle ACD$, $\angle CAB$
   B. $\angle ACB$, $\angle CAB$
   C. $\angle A$, $\angle 1$, $\angle B$
   D. $\angle A$, $\angle CAB$, $\angle 1$
   E. $\angle ACB$, $\angle 1$, $\angle B$

2. In the diagram:
   A. $\angle 1 = \angle 3$
   B. $\angle 1 = \angle 2$ and $\angle 3 = \angle 4$
   C. $\angle 2 = \angle 4$ and $\angle 2 = \angle 3$
   D. $\angle 1 = \angle 2$ and $\angle 3 = \angle 2$
   E. $\angle 1 = \angle 4$ and $\angle 2 = \angle 3$

3. A straight angle measures _______ degrees.

4. Two angles whose sum is $180^\circ$ are said to be _______ to each other.

5. A right angle measures _______ degrees.

6. Two angles whose sum is $90^\circ$ are said to be _______ to each other.
7. In the diagram, lines L & M are: ______  3-2 (1)

8. In the diagram, lines p & q are: ______  3-2 (2)

9. In the diagram:

I. $\angle 1 = \angle 2 = \angle 4 = \angle 5$
II. $\angle 1 = \angle 4 = \angle 5 = \angle 8$
III. $\angle 2 = \angle 3 = \angle 6 = \angle 7$
IV. $\angle 5 = \angle 8$ only
V. $\angle 5 = \angle 6 = \angle 8$

A. I & V  
B. II  
C. III  
D. II & III  
E. II & IV

10. Name: _______________  3-3 (5)
11. Name: ________________ 3-3 (6)

12. Name: ________________ 3-3 (7)

13. Name: ________________ 3-3 (8)

14. Name: ________________ 3-3 (9)

15. Name: ________________ 3-3 (10)
16. Name: __________________ 3-3 (11)

17. Name: __________________ 3-3 (12)

18. Name: __________________ 3-3 (13)

19. How many degrees are in the interior angles of the figure above? ____________ 3-3 (14)

20. A triangle with 2 equal sides is called an __________________ triangle. 3-4 (2)

21. The sum of the interior angles of a triangle is ____________. 3-4 (4)

22. A line joining the vertex and the midpoint of the opposite side of a triangle is called the _____________. 3-4 (12)
23. Find the length of side c in the right triangle ABC in the figure above.

24. OA is called the __________ of Circle O.

25. In circle O, AB is a chord and CD passes through O and is perpendicular to AB, therefore:
   A. OE = ED
   B. AE = ED
   C. AE = EB
   D. OD = AB
   E. None of these

26. If \( \overline{AB} = 50^\circ \), then central angle \( \angle AOB = \) \[\text{___________}\].
27. If $\overline{AB} = 100^\circ$, then inscribed $\angle ADB =$ \[3-5 \text{ (7)}\]

28. In the diagram, $AB$ & $BC$ are tangents to Circle $O$, from the same point $B$, therefore:

A. $AB = BC$ & $AO = AB$
B. $AB = OC$ & $\angle B = \angle AOC$
C. $AB = BC$, $OC \perp CB$, & $OA \perp AB$
D. $AO = BC$
E. $AB = BC$ only

29. Write the formula and find the area of triangle $ABC$:

Formula \[3-6\] Area \[3-6\]

30. Find the area & perimeter of rectangle $ABCD$:

Area \[3-6\] Perimeter
31. Find the area & circumference of Circle O. 3-6
Give the formulas.

Area ____________  Formula ____________

Circumference_____ Formula ____________
<table>
<thead>
<tr>
<th>Review Section</th>
<th>True - False Section</th>
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<tbody>
<tr>
<td>(3-1)</td>
<td>1. Vertical angles are always equal.</td>
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<td>2. A straight angle measures 90 degrees.</td>
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<td>3. Two angles supplementary to the same angle are equal.</td>
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<td></td>
<td>4. Two angles whose sum is 90 degrees are complementary angles.</td>
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<td>5. Adjacent angles are two angles with the same vertex and a common side.</td>
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<td>6. An angle bisector of an angle is a line that cuts the original angle in half.</td>
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<td>7. One degree equals 100 minutes.</td>
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<tr>
<td>(3-2)</td>
<td>8. Two lines are parallel if they meet only once.</td>
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<td></td>
<td>9. Perpendicular lines meet at right angles.</td>
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<td>10. If two lines in a plane are perpendicular to the same line, then they are parallel to the other.</td>
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<td></td>
<td>11. If a line is perpendicular to one of two parallel lines, it is parallel to the other.</td>
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<tr>
<td>(3-3)</td>
<td>12. A regular polygon is a polygon with no sides or angles equal.</td>
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<td>(3-4)</td>
<td>13. An equilateral triangle is one with two equal sides.</td>
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<td></td>
<td>14. The sum of any two sides of a triangle is equal to or greater than the third side.</td>
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<td></td>
<td>15. If two triangles are similar, then the corresponding sides are equal.</td>
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<td>16. Angle bisectors and medians are the same in any triangle.</td>
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<td>(3-4)</td>
<td>17. The side opposite the right angle in a right triangle is called the hypotenuse.</td>
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<td>18. The Pythagorean Theorem applies to all triangles.</td>
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<td>(3-5)</td>
<td>19. All radii of the same circle are equal.</td>
</tr>
<tr>
<td>&quot;</td>
<td>20. All chords of the same circle are equal.</td>
</tr>
<tr>
<td>&quot;</td>
<td>21. An inscribed angle has its vertex on the center of the circle.</td>
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<tr>
<td>&quot;</td>
<td>22. Concentric circles are circles with the same center.</td>
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<tr>
<td>&quot;</td>
<td>23. A tangent to a circle touches the circle at two points.</td>
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<td>&quot;</td>
<td>24. The formula for the area of a circle is $\pi r^2$.</td>
</tr>
<tr>
<td>&quot;</td>
<td>25. The formula for the area of a trapezoid is $\frac{1}{2}(a + b)h$. (a and b are the two bases, h = height.)</td>
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</table>
### Part 1 (Fill-in, Multiple choice)

1. D
2. B
3. 180 degrees
4. Supplementary
5. 90 degrees
6. Complementary
7. Parallel
8. Perpendicular
9. D
10. Triangle
11. Quadrilateral
12. Pentagon
13. Hexagon
14. Parallelogram
15. Rhombus
16. Rectangle
17. Square
18. Trapezoid
19. 540 degrees
20. Isosceles
21. 180 degrees
22. Median
23. 5
24. Radius
25. C
26. 50 degrees
27. 50 degrees
28. C
29. Formula = \( \frac{1}{2}bh \) Area = 12
30. Area = 24 Perimeter = 20
31. Area = 25\pi Formula = \pi r^2 Circumference = 10\pi Formula = 2\pi r or \pi D

### Part 2 (True-False)

1. True
2. False
3. True
4. True
5. True
6. True
7. False
8. False
9. True
10. True
11. False
12. False
13. False
14. True
15. False
16. False
17. True
18. False
19. True
20. False
21. False
22. True
23. False
24. True
25. True
APPENDIX M

DIAGNOSTIC GRAPH AND CHART TESTS

(WITH ANSWERS)
BAR GRAPH TEST

Questions 1-5 are based on this Bar Graph

THE NUMBER OF BLACK VOTERS HAS INCREASED SHARPLY IN THE SEVEN SOUTHERN STATES COVERED BY THE 1965 VOTING RIGHTS ACT

1. Which state has the greatest increase in the number of black voters?
   (A) Virginia          (D) Mississippi
   (B) Louisiana         (E) South Carolina
   (C) Alabama

2. In which state was the number of black voters almost doubled?
   (A) Louisiana         (D) Georgia
   (B) Mississippi        (E) Alabama
   (C) North Carolina

3. About what percent was the number of black voters in Mississippi in 1965 as compared to the number today?
   (A) 75%               (D) 20%
   (B) 125%              (E) 12½%
   (C) 800%
4. What was the total number of black voters in those seven states in 1965?

   (A) 1122 thousand  (B) 2138 thousand  (C) 958 thousand
   (D) 1715 thousand  (E) 1378 thousand

5. According to the chart, which state has the largest number of black voters at the present?

   (A) Louisiana  (B) Alabama  (C) Georgia
   (D) North Carolina  (E) Mississippi

Solutions

1. (D) Mississippi, which increased from 35 thousand to 281 thousand black voters had the greatest increase. (5-5)

2. (A) Louisiana increased from 163,000 black voters to 313,000 black voters, or almost doubled. (5-5)

3. (E) There were 35,000 black voters in 1965 and there were 281,000 today. 35,000 is about 1/8 or 12 1/2% of 281,000. (5-5, 1-25)

4. (A) The total number of black voters in 1965 was 163 + 35 + 113 + 254 + 143 + 245 + 169 = 1,122 thousand. (5-5)

5. (C) Georgia with 390,000 black voters has the largest number. (5-5)
Questions 1-5 are based on this Line Graph

PRICES RATIO SCALE 1957=100

1. On the ratio scale what were consumer prices recorded as of the end of 1965?

   (A) 95  (D) 110
   (B) 100  (E) 115
   (C) 105

2. During what year did Consumer prices rise fastest?

   (A) 1963  (D) 1968
   (B) 1965  (E) 1969
   (C) 1967

3. When Wholesale and Industrial prices were recorded as 110, Consumer prices were recorded as

   (A) between 125 and 120
   (B) between 120 and 115
   (C) between 115 and 110
   (D) between 110 and 105
   (E) between 105 and 100

4. For the 8 years, 1962-1969 inclusive, the average increase in Consumer price was
5. The percentage increase in Wholesale and Industrial prices between the beginning of 1962 and the end of 1969 was

(A) 1 percent  
(B) 5 percent  
(C) 10 percent  
(D) 15 percent  
(E) less than 1 percent

Solutions

1. (D) Drawing a vertical line at the end of 1965, we reach the Consumer price graph at about the 110 level. 

2. (E) The slope of the Consumer graph is clearly steepest in 1969. 

3. (A) Wholesale and Industrial prices were about 110 at the beginning of 1969, when Consumer prices were between 120 and 125. 

4. (C) At the beginning of 1962 Consumer prices were about 105; at the end of 1969 they were about 130. The average increase is \( \frac{130 - 105}{8} = \frac{25}{8} \) or about 3. 

5. (D) At the beginning of 1962 Wholesale prices were about 100; at the end of 1969 they were about 115. The percent increase is about \( \frac{115 - 100}{100} \times 100\% \) or 15%. 

(5-4, 1-25)
Questions 1-5 are based on this Pie Chart.

POPULATION BY REGION, 1964

1. Which region was the most populated region in 1964?

(A) East North Central
(B) Middle Atlantic
(C) South Atlantic
(D) Pacific
(E) New England
2. What part of the entire population lived in the Mountain region?
   (A) 1/10          (D) 1/25
   (B) 1/30          (E) 1/8
   (C) 1/30

3. What was the approximate population in the Pacific region?
   (A) 20 million      (D) 28 million
   (B) 24 million      (E) 15 million
   (C) 30 million

4. Approximately how many more people lived in the Middle Atlantic region than in the South Atlantic?
   (A) 4.0 million     (D) 9.3 million
   (B) 7.7 million     (E) 8.5 million
   (C) 5.2 million

5. What was the total population in all the regions combined?
   (A) 73.3 million    (D) 126.8 million
   (B) 100.0 million   (E) 98.5 million
   (C) 191.3 million

Solutions

1. (A) East North Central with 19.7% of the total population had the largest population. (5-3)

2. (D) The Mountain region had 4.0% of the population. 4.0% is 1/25. (5-3, 1-23)

3. (B) Pacific had 12.5% of the population. 12.5% of 191.3 million is .125 x 191.3 or about 24 million. (5-3, 1-25)

4. (B) Middle Atlantic had 18.8% and South Atlantic had 14.8% of the population. So, Middle Atlantic had 4.0% more. 4.0% of 191.3 million is .04 x 191.3 or about 7.7 million. (5-3, 1-25)

5. (C) All the regions combined had 100% of the population or 191.3 million. (5-3)
APPENDIX N

LIST OF IMPORTANT DO'S AND DON'TS
LIST OF IMPORTANT DO'S AND DON'TS

DO GET A GOOD NIGHT'S SLEEP BEFORE THE EXAMINATION
DON'T MAKE EXTREME CHANGES IN DAILY ROUTINE
DO WORK CAREFULLY ON THE GRE
DON'T CRAM THE NIGHT BEFORE
DO MAKE EDUCATED GUESSES WHEN YOU CAN ELIMINATE
DON'T GUESS BLINDLY
DO LOOK AT ALL ANSWERS BEFORE MAKING A FINAL CHOICE
DO ELIMINATE UN-NEEDED INFORMATION IN PROBLEM
DON'T COMPLICATE A PROBLEM
DO MAKE SURE YOU ARE ANSWERING THE RIGHT QUESTION
DO WORK THE ONES YOU KNOW FIRST, THEN COME BACK AND DO THE OTHERS
APPENDIX O

POSTTESTS B AND C

(SAMPLE TESTS WITH ANSWERS)
SAMPLE TEST B

SECTION I

Time: 40 Minutes

1. Which of the following fractions is greater than 1/3?
   (A) 17/32  
   (B) 10/61  
   (C) 33/100  
   (D) 16/45  
   (E) 51/154

2. If, on a certain school day, 1 out of every 4 students is absent, what percent of the students is present?
   (A) 33 1/3%  
   (B) 80%  
   (C) 66 2/3%  
   (D) 90%  
   (E) 75%

3. If $x^5 + 5x^4 + 3x + 2 = x^5 + 5x^4 + 9x - 22$, then $x =$
   (A) 12  
   (B) 4  
   (C) 3  
   (D) 8  
   (E) 5

4. If $y = 5$ then $\sqrt{16 - 8y + y^2} =$
   (A) -1  
   (B) 0  
   (C) 4  
   (D) 1  
   (E) 3

5. The diagram above shows two squares, each of whose sides equals 20. If $BC = 6$ and $CF = 5$ then what is the length of $DE$?
   (A) 12  
   (B) 15  
   (C) 18  
   (D) 19  
   (E) cannot be determined from the information given
6. Find \( x \) if \( xy = 120x \) and \( y = 48z \).

   (A) 5 \hspace{1cm} (D) \( \frac{5}{2} \)
   (B) 1 \hspace{1cm} (E) 2
   (C) \( \frac{3}{4} \)

7. Successive discounts of 30% and 10% on an item are equivalent to a single discount of what percent?

   (A) 40% \hspace{1cm} (D) 33 \frac{1}{3}%
   (B) 35% \hspace{1cm} (E) 25%
   (C) 37%

8. 

   ![Diagram](image)

   In the diagram, each unit along the x-axis represents 5 inches and each unit along the y-axis represents 6 inches. Which of the figures has (have) an area of 240 square inches?

   (A) I, and II \hspace{1cm} (D) none of the figures
   (B) II, IV, and V \hspace{1cm} (E) all of the figures
   (C) I, II, III, and IV

9. If \( m \times n = p \) and \( p \neq 0 \) where \( m \), \( n \), and \( p \) are real numbers, which of the following must be true?

   (A) \( p \) is an integer \hspace{1cm} (D) \( m \times p = n \)
   (B) \( m \neq 0 \) \hspace{1cm} (E) \( n \times p = m \)
   (C) \( m \div n = p \)

10. 

    ![Diagram](image)

    In the diagram, squares are drawn on the three sides of right triangle \( ABC \). Which of the following triangles is congruent to triangle \( ACU \)?
11. Which of the following must be positive?

I. the product of 2 positive numbers
II. the product of 2 negative numbers
III. the sum of 2 negative numbers

(A) I only
(B) II only
(C) I and III only
(D) I and II only
(E) I, II, and III

12. Which equation represents the following information:
   Twice a number, y, is 5 less than 3 times another number, x?

(A) \( y = 15 - x \)
(B) \( 2y = 3x - 5 \)
(C) \( y = 2(3x - 5) \)
(D) \( 2y = 5 - 3x \)
(E) \( 2y = 3x - 15 \)

13. Which of the following figures can be drawn in one motion without lifting the pen until finished and without drawing over a line segment more than once?

(A) all of the figures
(B) none of the figures
(C) I and II
(D) I and IV
(E) I, II, and IV

14. A man has a job which requires him to work 8 straight days and rest on the ninth day. If he started work on a Monday, the 12th time he rests will be on what day of the week?

(A) Sunday
(B) Wednesday
(C) Tuesday
(D) Friday
(E) Saturday
In the diagram, the coordinates of points A and B are (-2,3) and (4, -1) respectively. If AC is parallel to the Y-axis and BC is parallel to the X-axis, what is the length of AC?

(A) 4  (B) 2  (C) 7  (D) -5  (E) 5

Questions 16-20 refer to the graphs below.

UNITED STATES PAINT SOLD WORLDWIDE

1958 total - $40 million  1967 total - $50 million
16. In 1953, how much more paint in dollars was sold to the largest buyer than to the second largest?

(A) $3 million  
(B) $4 million  
(C) $1.5 million  
(D) $1 million  
(E) $10 million

17. Which area increased most in regard to the amount of paint bought from 1958 to 1967?

(A) Central America  
(B) Asia  
(C) Oceania  
(D) Africa  
(E) Europe

18. From 1958 to 1967, the increase of the amount of paint bought in Oceania was about what percent of the total increase of U.S. paint sold?

(A) 7%  
(B) 3%  
(C) 1%  
(D) 2.5%  
(E) 5%

19. In the graph for 1967, what is the central angle of the sector that represents the amount of paint sold to Central America?

(A) 60°  
(B) 45°  
(C) 12.5°  
(D) 30°  
(E) 15°

20. Which region bought the same amount of paint from the U.S. in 1958 as in 1967?

(A) Central America  
(B) South America  
(C) Africa  
(D) Canada  
(E) none of the regions

21. For any two real numbers m and n, which of the following statements is (are) not always true?

I. \( m^2 + n^2 = (m + n)^2 \)
II. \( m^2 - n^2 = (m - n)^2 \)
III. \( m^2 n^2 = (mn)^2 \)

(A) I only  
(B) II only  
(C) I and II only  
(D) II and III only  
(E) I, II, and III
22. A regular working day is 8 hours and a regular week is 5 working days. A man is paid $2.40 per regular hour and $3.20 per hour overtime. If he earns $432 in 4 weeks, what is the total number of hours he works?

(A) 180  (D) 195
(B) 175  (E) 200
(C) 160

23. In the figure above, A has coordinates (4,3) and B has coordinates (-1,6). What are the coordinates of point C?

(A) (3,6)  (D) (6,-1)
(B) (-1,4)  (E) (4,6)
(C) (3,-1)

24. Consider another operation, \(\cdot\), defined

\[ a \cdot b = \frac{a}{b} - \frac{b}{a} \]

For which of the following values for \(a\) and \(b\) is \(a \cdot b\) undefined?

(A) \(a = 1/2, \ b = 2\)  (D) \(a = 10^2, \ b = 10^3\)
(B) \(a = 1, \ b = 1\)  (E) \(a = \sqrt{2}, \ b = \sqrt{3}\)
(C) \(a = 2, \ b = 0\)

25. 2/3 is to 5/6 as 3/7 is to what number?

(A) 5/3  (D) 23/21
(B) 10/7  (E) 17/14
(C) 13/14
26. If \( r, s, \) and \( t \) are consecutive odd integers with \( r < 3 < t \), which of the following must be true?

(A) \( rs = t \)  
(B) \( r+t = 2t-s \)  
(C) \( r+s = t+2 \)  
(D) \( s+t = r+2 \)  
(E) \( r+t = 2s \)

27. If we know that \( x+y+z = 1 \), and also \( x-y-z = 2 \), then what is the value of \( x \)?

(A) 0  
(B) 3  
(C) -1  
(D) \( \frac{3}{2} \)  
(E) cannot be determined from the information given

28. 

![Diagram](image)

In the diagram, if \( AD \) meets \( BC \) at \( E \), which of the following is always true?

(A) \( \angle A + \angle D = \angle B + \angle C \)  
(B) \( \angle A + \angle B = \angle D + \angle C \)  
(C) \( \angle 1 + \angle 2 = 90^\circ \)  
(D) \( \angle A \) is supplementary to \( \angle C \)  
(E) \( \angle B = \angle D \)

29. If \( x-y = x+y \) then \( y = ? \)

(A) -5  
(B) -x  
(C) 2x  
(D) -1  
(E) 0
30. If the diameter of each wheel of a train is 3 feet and the speed of the train is 45 miles per hour, what is the number of revolutions per minute each wheel turns? (Assume $\pi = 22/7$)

(A) 996  
(B) 420  
(C) 512  
(D) 2520  
(E) 480
### Answers to Posttest B

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<tr>
<td>1.</td>
<td>D</td>
<td>26.</td>
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<td>2.</td>
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<td>27.</td>
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<td>4.</td>
<td>D</td>
<td>29.</td>
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SAMPLE TEST C

SECTION 1

Time: 40 minutes

1. A company sells pens at a price of $1.00 per dozen, but gives a 15% discount on any order which exceeds twelve dozen. If a merchant wants to get three thousand pens, how much will he have to pay?

   (A) $174.25  (D) $235.00
   (B) $205.00  (E) $250.00
   (C) $212.50

2. If $p^5 + 2p^4 = (p + 1)^3 - p^3$, then $p = ?$

   (A) -1 only  (D) -1 or +1 only
   (B) 0 only   (E) none of the above
   (C) +1 only

3. In order to obtain admission into a special school program, all applicants must take a special exam, which is passed by three out of every five applicants. Of those who pass the exam, one-fourth are finally accepted. What is the percentage of all applicants who fail to gain admission into the program?

   (A) 55  (D) 85
   (B) 60  (E) 90
   (C) 75

4. If $m = -3$, then what is the value of $m^3 + 4m + 4$?

   (A) -11  (D) +1
   (B) -5  (E) +25
   (C) -1

5. Which of the following fractions is greater than $1/4$?

   (A) $25/135$  (D) $41/180$
   (B) $17/70$  (E) $27/110$
   (C) $26/103$
In the above diagram, ABCD and EFGH are squares. If the area of the shaded rectangle is \( \frac{2}{9} \) of the area of ABCD, and \( \frac{1}{8} \) that of EFGH, what is the ratio of side AB to side GH?

(A) 1:2  
(B) 3:4  
(C) 2:3  
(D) 9:16  
(E) cannot be determined from the given information

7. If \( a^2 = 2b^2 \), and \( a \) is an integer, which of the following is true:

(A) \( b \) is an even integer for every value of \( a \)
(B) \( b \) is an even integer for some values of \( a \), and an odd integer for the others
(C) \( b \) is an integer for some values of \( a \), and a rational number (not an integer) for others
(D) \( b \) is a rational number for some values of \( a \), and an irrational number for others
(E) \( b \) is an irrational number for every value of \( a \)

8. If \( 6r = s \), and \( s^2 = 144 \), what is the value of \( r \)?
(assume \( r > 0 \))

(A) \( 1/3 \)  
(B) 2  
(C) 6  
(D) 12  
(E) 24
9.

In the diagram above, if each unit along the X axis represents 2 feet, and each unit along the Y-axis represents 5 feet, which of the figures has the largest area?

(A) I  
(B) II  
(C) III  
(D) IV  
(E) V

10. An item which originally sold for $140 was discounted by 40%, and then by 20%. What was the final selling price?

(A) $67.20  
(B) $72.00  
(C) $76.80  
(D) $80.00  
(E) $84.00

11.

In the diagram above, if the coordinates of point P are (5, 4), and the coordinates of point Q are (1, -2), what are the coordinates of point R?
12. A man wishes to cover his 9-foot room with square tiles, all the same size. He wants to use white and black squares, in checkerboard fashion, so that there is a black square at each corner. All these conditions can be met if

(A) the tiles measure 4 inches on each side
(B) the tiles measure 6 inches on each side
(C) the tiles measure 8 inches on each side
(D) the tiles measure 4 inches, 6 inches, or 8 inches on each side
(E) all of the above are true

13. If we start with a number \( n \), add four, multiply the result by three, and then subtract two, what algebraic expression represents the final result?

(A) \( n + 10 \)
(B) \( 3n + 6 \)
(C) \( (n + 4)(3 - 2) \)
(D) \( (3n + 4) - 2 \)
(E) \( 3(n + 4) - 2 \)

14. Which of the following figures can be drawn without removing your pencil from the paper, and without retracing any lines?

![Figure I](image1)
![Figure II](image2)
![Figure III](image3)
15. Which of the following must be odd:

I. the sum of an even number and an odd number
II. the product of an even number and an odd number
III. the sum of two odd numbers

(A) I only   (D) two of the three choices
(B) II only  (E) all three choices
(C) III only

16. A man wants to adjust the extension ladder pictured above to a height of 172 inches. When he does, what will be the length of the overlap, \( x \)?

(A) 1 foot, 8 inches   (D) 4 feet, 6 inches
(B) 2 feet             (E) 5 feet, 4 inches
(C) 3 feet, 4 inches   

17. If \( 1 + a = 3b \), what is the value of \( a^2 - 6ab + 9b^2 - 1 \)?

(A) -3       (D) 2
(B) -1       (E) cannot be determined from the given information
(C) 0
18. If \( S(a,b,c) \) is defined as \( a^2 + b^2 - c^2 \), for which of the following is \( S(a,b,c) = 0 \) true?

(A) \( a=5, b=4, c=9 \)  \hspace{1cm} (D) \( a=6, b=8, c=10 \)

(B) \( a=2, b=3, c=6 \)  \hspace{1cm} (E) \( a=3, b=6, c=4 \)

(C) \( a=7, b=11, c=15 \)

19. If \( a^2 > 1+b^2 \), which of the following must be true?

(A) \( (a+b) (a-b) > 1 \)  \hspace{1cm} (D) \( a^2b^2 < a^2-1 \)

(B) \( a>b \)  \hspace{1cm} (E) none of these

(C) \( a^2+b^2 < 1 \)

20. If \((a,b)\) designates the set of all numbers that are both greater than \( b \) and less than \( a \), which of the following is true?

(A) \((1,2)\) includes all numbers

(B) \((2,2)\) and \((3,3)\) define the same set

(C) \((1,7)\) and \((7,1)\) define the same set

(D) \(3,6,\text{ and }9\) are all members of \((7,5)\)

(E) there are no members in the set \((2,0)\)

21. A stenographer does typing work at the following rate: 5¢ per sheet of typing paper used and $3.00 per hour of typing. He can type 60 words a minute, and types on paper which holds 30 lines per page, and 10 words per line. How much will he charge to type an 1800-word paper, with two carbon copies?

(A) $2.40  \hspace{1cm} (D) $9.15

(B) $4.10  \hspace{1cm} (E) $10.50

(C) $6.50

22. \( \frac{2}{9} \) of \( \frac{2}{3} \) is equal to \( x \) times \( \frac{5}{6} \). What is the value of \( x \)?

(A) \( \frac{1}{9} \)  \hspace{1cm} (D) \( \frac{81}{25} \)

(B) \( \frac{4}{9} \)  \hspace{1cm} (E) \( \frac{1}{75} \)

(C) \( \frac{4}{25} \)
In the above diagram, angles B and D are right angles. Which of the following can be correctly concluded?

I. AB + BC = AD + DC
II. \(\angle BAC + \angle BCA = \angle CAD + \angle ACD\)
III. \(\frac{AB}{DC} = \frac{BC}{AD}\)

(A) I only    (D) II and III only
(B) II only   (E) none of the above
(C) I and III only

Questions 24-27 are based on the graph below.

24. What per cent of the population is in the category "Not in Labor Force"?
25. About how many degrees are there in the shaded part of the circle?

(A) 110
(B) 137
(C) 126

26. One-half of the students in the country are in college. How many college students are there?

(A) 2,560,000
(B) 4,230,000
(C) 4,466,000

27. Approximately what per cent of the "Civilian Labor Force" are the unemployed?

(A) 1.6
(B) 1.9
(C) 0.5

28. If a, b, c and d are a series of positive numbers such that each number is twice the previous one, which of the following must be true?

(A) ac = bd
(B) a + b + c = d
(C) a + c = b + d

29. A man has ten pennies, ten nickels, five dimes and four quarters. He buys something for $1.15, and wishes to get rid of as many coins as possible. How many coins does he pay for the object? (Assume he pays exactly.)

(A) 22
(B) 23
(C) 24

30. Container A holds twice as much as container B, and container C holds as much as A and B put together. If we start with A and B full, and C empty, and pour half the contents of A and a third of the contents of B into container C, what fraction of C's capacity will be filled?
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ANSWERS TO POSTTEST C

1. C
2. D
3. D
4. D
5. A
6. E
7. E
8. B
9. B
10. A
11. A
12. A
13. E
14. E
15. A
16. A
17. C
18. D
19. A
20. B
21. A
22. C
23. B
24. E
25. B
26. C
27. E
28. E
29. C
30. B
APPENDIX P

FINAL EVALUATION FORM

(POST-QUESTIONNAIRE)
LEARNING RESOURCE CENTER, CALIFORNIA STATE UNIVERSITY, NORTHRIDGE

GRE PREP SESSION EVALUATION FORM

1. How many meetings have you attended this session?
   (Total 8) _______ (Total 10) _______

2. Do you feel that this session was helpful to you?
   Why? or Why Not?

3. How do you feel about taking the GRE now?

4. Please comment briefly and rate the following:
   (Rate: 5 Excellent to 1 Poor)
   ___ A. Length of session - 4 weeks - 5 weeks
   ___ B. Length of meetings - 1 3/4 to 2 hours
   ___ C. Material covered
   ___ D. Handouts, diagnostic tests, etc.
   ___ E. Instruction
   ___ F. Assignments

5. Other comments or suggestions

Thank You and Good Luck!