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MATHEMATICS ACHIEVEMENT TESTS IN SUDANESE  
INTERMEDIATE SCHOOLS

By

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## ABSTRACT

The intermediate school in the Sudan consists of grades five through eight. At the end of this stage the "Intermediate Final and Secondary Entrance Examinations" are conducted. The prevailing Intermediate Final Mathematics examination is of the essay type, and, thus is likely to exhibit the limitations commonly associated with essay examinations.

The main purpose of this study is to find out whether this type of examination needs improvement. To achieve this purpose two examinations were given to a representative sample of students in the final grade (1967/68) of some Sudanese intermediate schools. The first was a 'typical' Intermediate Final Mathematics (set by the head of the Department of Mathematics, Bakht er-Ruda, who is actually responsible for setting this test), and the second, a suggested substitute, was set by the investigator. The performances of the students on these tests, and prior Intermediate Final Mathematics papers furnish the basic data for this study.

The study of the results of the two tests included:

- 1) measuring reliability,
- 2) measuring validity and comprehensiveness,
- 3) measuring objectivity, and
- 4) performing detailed item analyses, including difficulty and discrimination indexes.

The statistical analyses of the results of the two tests yielded almost equal coefficients of reliability and objectivity. It was found that the Intermediate Final Mathematics needs improvement in validity. In general, the suggested alternate test had better indices of difficulty and discrimination.

As a result of the entire study, a proposal is made for the improvement of the prevailing Intermediate Final Mathematics examination as follows. This examination should consist of two papers: one of the objective type, and the other of the essay type. Improvement of content validity can be attained by having a test of the objective type (similar to the test suggested in this study). Because not all of the objectives of teaching mathematics at the intermediate school lend themselves to measurement by an objective examination (as, for example, producing a long hand proof) an essay type (similar to the prevailing Intermediate Final examination) is also needed to test those objectives and outcomes of

instruction which the objective type of test fails to measure adequately.

## CHAPTER I

### INTRODUCTION

#### A. The Nature of Achievement:

Achievement, which is the accomplishment of actual learning, must be distinguished from aptitude for learning (intelligence). In order to measure aptitude for learning, an indirect approach must be used, since no way has been found to measure intelligence directly. It has been always inferred from its products. When testing for intelligence, the test maker attempts to discover what the individual has learned in situations experienced by a vast majority of persons. The underlying assumption is that all examinees have had the same opportunities to learn the measured areas, and that the differences in scores result from differences in aptitude rather than in opportunities for learning. Another way to test for intelligence is to create situations which are so completely novel that it is unlikely that any of the testees have had any previous experience in the area being tested.

Scholastic achievement tests differ from the

general aptitude tests in that they are based on the acquisition of special skills and knowledge, which are usually a result of special training. In other words, they involve two elements, namely, the opportunity to learn and the attainment of special skills or knowledge as a result of learning.<sup>1</sup>

B. Measuring Achievement:

"Anything that exists at all exists in some quantity, and anything that exists in some quantity is capable of being measured."<sup>2</sup> This is true of educational achievement which can be measured by the proper use of adequate instruments. It is the responsibility of the teacher to use measuring devices that are as accurate as possible. This is a challenge that requires a thorough understanding of the existing measuring instruments as well as the problems of measurement that remain to be solved.

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<sup>1</sup>Denis Baron and Harold W. Bernard, Evaluation Techniques for Classroom Teachers (New York: McGraw-Hill Book Company, Inc., 1958), pp. 87-89.

<sup>2</sup>E.L. Thorndike, "The Nature, Purposes and General Methods of Educational Products", The Measurement of Educational Products, Seventeenth Yearbook of the National Society for the Study of Education, Part II (Bloomington, Illinois, Public School Publishing Co., 1918), p. 16.

The measurement of scholastic achievement provides the teacher with the essential data for planning, pupil guidance, evaluation of the effectiveness of his methods of instruction, development of learning situations suited to the needs and capacities of individual pupils, discovery of areas of particular strength, and development of remedial programs. "However, achievement tests do not automatically solve educational problems, nor do they necessarily further the attainment of worthwhile educational objectives."<sup>1</sup> Measuring instruments are tools whose value depends upon the skill with which they are handled.

An achievement test is an instrument designed to measure the extent of relative acquisition of certain knowledges or skills as a result of a specified program of instruction. There are two major steps for the development of an achievement test (or any other measuring instrument): (1) determining exactly what is to be measured, and (2) obtaining or constructing a measuring instrument that will best do the measuring. In other words, the examiner must conscientiously define 'what' to measure, and then 'how' best

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<sup>1</sup>Baron and Bernard, op.cit., p. 89.

to measure it.<sup>1</sup>

C. Purposes of Evaluation:

The main purpose of evaluation should be the improvement of the function of the school. Any achievement test that does not serve this purpose has little value. According to Micheels and Karnes<sup>2</sup>, some of the uses of tests in schools are the following:

1. Administrative Uses of Tests:

Initially, tests were used almost entirely for administrative purposes, namely, for promoting students from one grade to another, or from one stage to the succeeding one. Needless to say that scholastic scores should be considered as means to an end rather than an end in themselves. They can be put in their appropriate perspective by using them intelligently and making them more meaningful.

2. Curriculum Development:

Well-prepared measuring instruments can be of vital importance in determining the effectiveness

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<sup>1</sup>William J. Micheels and M. Ray Karnes, Measuring Educational Achievement (New York: McGraw-Hill Book Company, Inc., 1950), pp. 22-24.

<sup>2</sup>Ibid., pp. 79-92.

of a curriculum. Results of tests should reveal the changes that should be made in order to accomplish the goals that have been set. The underlying assumption here is that tests are constructed in terms of the objectives that have been established. If tests are constructed in this manner, then they can indicate the suitability of the subject matter.

3. Improvement of Instruction:

One of the main uses of school tests should be the improvement of methods of instruction. An analysis of the results of good tests may provide a fairly accurate idea about the way students learn. The teacher can determine the relative effectiveness of his various methods of teaching. By interpreting the test scores, the teacher can obtain a good picture of the potentialities of each student.

It should be pointed out that high test scores do not necessarily indicate high achievement. When studying the results of a test for the improvement of instruction, the teacher must be aware of the possibility that high scores may reflect simplicity of test items or a low level of cognition that is being measured.



4. Assignment of Scores:

It is natural that different students learn with different degrees. The classroom teacher needs to determine the relative standing of each student by assigning a score to each student and consequently by ranking the students according to their accomplishments. In addition, the teacher needs to determine which students have reached the required (or minimum) standard of performance and which have not. It is of vital importance, therefore, that the teacher construct his tests in such a manner that the resulting scores truly indicate relative achievement. This is a challenge that calls for the best efforts in setting reliable and valid tests.

5. Incentive for Study:

"It would be nice (perhaps) if all students in a school were interested in learning all they possibly could whether or not a check were made on their progress. This, however, is not the case. A few will put forth their best efforts whether or not tests are given. But the majority will work harder if they know that they are to be held accountable for what has been taught. Generally, the instructor who administers the most rigid program of evaluation

gets/<sup>the</sup>greatest amount of work out of his students."<sup>1</sup>

D. Background Statement:

1. A Felt Problem:

The intermediate school, in the Sudan, is the second cycle in the educational ladder. It consists of Grades five through eight. At the end of this stage, the Sudan Examinations Council conducts the "Intermediate Final and Secondary Entrance Examinations", hereafter referred to as "Intermediate Final Examinations". These examinations serve two purposes: (1) to determine success at the intermediate school level, and (2) to select candidates for secondary schools (the stage succeeding the intermediate school) and other post-intermediate institutions.

All the intermediate schools have exactly the same text-books, and the same Intermediate Final Examinations, which are conducted every April. The construction and grading of these examinations are among the responsibilities of the Institute of Education, Bakht er-Ruda. In fact, the Principal of the Institute of Education delegates the responsibility of constructing and scoring the Intermediate

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<sup>1</sup>Ibid., p. 89.

Final Examinations to the heads of the departments, who may invite some or all members of their departments to share this responsibility.

The "Intermediate Final and Secondary Entrance Examinations - Mathematics", hereafter referred to as Intermediate Final Mathematics, consists, normally, of eight open-ended questions. Although the examinees are officially responsible for the material assigned to the four years of the intermediate school, they are in fact responsible also for the material presented in the preceding stage (i.e., the elementary school) because of the sequential nature of the subject matter.

The writer has joined the Department of Mathematics in the Institute of Education, Bakht er-Ruda since his graduation from the American University of Beirut in 1960. He has taken part in constructing and scoring the Intermediate Final Mathematics for three years (1961 through 1963); and after he has become the head of the Department of Mathematics in 1963, he has been responsible for constructing and scoring the Intermediate Final Mathematics for another three years (1964 through 1966). The writer feels, as an outcome of his first-hand experience that there exists some shortcomings in the prevailing Intermed-

iate Final Mathematics.

Intuitively, when an attempt is made to make the eight examination questions (in the Intermediate Final Mathematics) cover such a huge material, some of the questions are bound to be overloaded, and thus complicated and artificial. Otherwise, the examination is far from being comprehensive.

The second presumed difficulty is scoring the answers of about ten thousand candidates objectively. One of the sources of this difficulty is the misinterpretation of the handwriting of examinees, especially concerning numerals and mathematical signs. Another source of difficulty for objectivity in scoring is the arising of unique methods of solution that were not anticipated by the examiners.

## 2. Results of the Intermediate Final Examinations:

The six subjects in the Intermediate Final Examinations are religion, Arabic, English, mathematics, history, and geography. Each of the first four subjects weighs a hundred points, and each of the remaining two subjects weighs sixty points. Thus the maximum possible score in the Intermediate Final Examinations is 520 points.

The results of the Intermediate Final Examinations are given in terms of the accumulated sum of

scores in the six subjects. This means that even one half of a point in any subject influences the status of the student in terms of passing the intermediate level or selection for the secondary schools or other post-intermediate institutions.

It can be seen from Table 1 that about two thirds of the candidates for the Intermediate Final Examinations pass, and about one half of those who pass are accepted in secondary schools. Such a situation necessitates the use of highly reliable (as well as valid) examinations that yield highly reliable scores which must be obtained as efficiently as possible.

TABLE 1

RESULTS OF THE INTERMEDIATE FINAL  
EXAMINATIONS 1961-1965<sup>a</sup>

| Year | Number of Candidates | Number of Successful Candidates | Percentage of Success | Enrolment in Secondary Schools | Percentage of Enrolment in Secondary Schools |
|------|----------------------|---------------------------------|-----------------------|--------------------------------|--|
| 1961 | 7903                 | 5792                            | 73.3                  | 2251                           | 28.5   |
| 1962 | 8948                 | 5371                            | 60.1                  | 2589                           | 28.9   |
| 1963 | 9029                 | 6544                            | 72.5                  | 3731                           | 41.3   |
| 1964 | 9711                 | 4966                            | 51.1                  | 3960                           | 40.8   |
| 1965 | 9908                 | 5449                            | 55.0                  | 3812                           | 38.5   |
|      | 45 499               | 28122                           | 61.8                  | 16343                          | 35.9   |

<sup>a</sup>Adapted from tables produced in: Ministry of Education, Educational Statistics, Khartoum, Publications Bureau, 1962 through 1966.

E. The Purpose of the Study and the Statement of the Problem:

The purpose of this study is to investigate the possibility of constructing an improved instrument for evaluating achievement in mathematics at the end of the intermediate stage.

The problem, then, is to examine critically the

prevailing "Intermediate Final Mathematics" and to compare it with a suggested instrument (mainly an objective type of test) with the intention of making proposals for its improvement.

Operationally, the purpose is to answer the following questions:

- 1) Which of the two types of test yields more reliable scores?
- 2) Which of the two types is more valid?
- 3) How do the grades yielded by a 'typical' Intermediate Final Mathematics" correlate with the different levels of understanding?

F. Significance of the Study:

The significance of this study is twofold. In the first place, it aims at investigating an important aspect in education, namely, measurement of achievement. In fact, the methods of evaluating or measuring achievement might need continual study and review. Secondly, to the best knowledge of the writer, no attempt has been made in the Sudan to investigate the effectiveness of the prevailing Intermediate Final Mathematics. It is sincerely hoped that this study may initiate further research in measuring

achievement in mathematics in the different stages. It is equally hoped that this research may also initiate studies in the systems of evaluation in the other subjects.

From the operational point of view, the writer hopes that the Department of Mathematics at the Institute of Education, Bakht er-Ruda, which is actually responsible for setting the Intermediate Final Mathematics, will give this study the attention it deserves.



## CHAPTER II

### SURVEY OF RELATED LITERATURE

In this chapter, the characteristics of good tests, as well as the uses of two main types of tests, namely, essay and objective tests, will be discussed.

#### A. Desirable Characteristics of Tests:

A good test is characterized by:

1. a high degree of validity,
2. high reliability,
3. objectivity,
4. discrimination, and
5. comprehensiveness.

All these factors are interdependent; yet for the sake of discussion each will be considered separately. As these concepts can be referred to in texts dealing with tests and measurement, the writer's intention is to initiate further study by pointing out some of the crucial points.

#### 1. Validity:

A test is valid if it measures what it is

supposed to measure. Micheels and Karnes<sup>1</sup> regard validity as the most important feature of a good test. A test may be valid for one purpose but not for another, and it may be valid for a particular group of students but not for all groups of students even if they belong to the same grade level.

One method of determining the validity of a test is to compare it with an external criterion which is considered to be valid for the purpose at hand. Another method is to consider the validity of individual items, since the validity of the whole test depends on the validity of the items that constitute it. In some cases, it may be useful, as well as desirable, to give first attention to the validity of the individual items than to the validity of the test as a whole.

## 2. Reliability:

Remmers, Gage, and Rummel<sup>2</sup> consider reliability the most available significant statistical mea-

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<sup>1</sup>Micheels and Karnes, op.cit., pp. 104-111.

<sup>2</sup>H.H. Remmers, N.L. Gage, and J.Francis Rummel, A Practical Introduction to Measurement and Evaluation (New York: Harper and Brothers, 1960), pp. 117-122.

sure of the quality of an achievement test. Although validity is generally considered to be more important than reliability, the statistical validity of a classroom test cannot ordinarily be determined, since it requires an external criterion which is seldom available.

A test is reliable if it measures accurately and consistently whatever it measures. It can easily be seen that reliability is a necessary (but not sufficient) condition for validity.

Operationally, the reliability of a set of scores can be defined as the coefficient of correlation between that set of scores and another set of scores obtained from the equivalent test given to the members of the same group. The reliability of a test can be estimated by one of the following methods:<sup>1</sup>

a) Test-Retest Method

This method of estimating reliability requires that the same test be administered twice to the same group of students. One of the drawbacks of this method is that the interference of memory is neglected.

b) Equivalent-Forms Method

This method requires that two forms of the test be equivalent in terms of content, mental pro-

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<sup>1</sup>Robert L. Ebel, Measuring Educational Achievement (New Jersey: Prentice-Hall, Inc., 1965), pp. 312-318.

cesses involved, number of items, difficulty, and the other aspects. The students take the two forms independently. Reliability in this case is expressed by the coefficient of linear correlation between the scores yielded by the two forms.

c) Split-Halves Method:

After the test is administered, the items are divided into two halves. Normally, the two halves are the odd-numbered and the even-numbered items. The correlation between the two halves reflects the reliability of half of the test. The Spearman-Brown prophecy formula can be used to estimate the reliability of the whole test as follows:

$$\text{Reliability of lengthened test} = \frac{nr}{1 + (n-1)r},$$

where

n = number of times test is lengthened

r = original reliability coefficient.

When r is the reliability of one half of the test, the above formula becomes:

$$\text{Reliability of whole test} = \frac{2(\text{reliability of half test})}{1 + (\text{reliability of half test})}$$

d) Kuder-Richardson Method

The reliability, r, of a test can be estimated by using Kuder-Richardson formula:

$$r = \frac{k}{k-1} \left[ 1 - \frac{pq}{\sigma^2} \right], \text{ where}$$

k = number of items in the test

p = proportion of persons passing each item

q = 1 - p

$\sigma^2$  = the variance of the scores of the test.

It is generally believed that the objective type of test yields more reliable and valid scores than does the essay type. This is verified by research findings. "Results of essay-type papers by 11-year-old children indicated that even under ideal conditions, with a rigorous system of marking, the essay-type papers do not achieve either the reliability or validity of objective tests".<sup>1</sup>

Again "two studies showed that serious problems of unreliability in essay testing remain. Anderson (1960) carried out a well-designed analysis of variance study to investigate the extent of variability contributed by tests, testing occasions, markers, marking occasions, and their interactions. Fifty-five eighth-grade students were administered

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<sup>1</sup>R.L. Ebel, and R.E. Hill, "Development and Applications of Tests of Educational Achievement", Review of Educational Research, Vol. 29, No. 1 (February, 1959), p. 43.

the Sequential Tests of Educational Progress (STEP) Essay test, Form A and Form B, for level 3, on four testing occasions. On four different marking occasions, each of three markers marked all 440 essay (eight from each of 55 students)"<sup>1</sup>. The group analysis showed a large amount of unreliability.

### 3. Objectivity (Scorer reliability)

One of the functions of a test is to reduce the subjective element in judgment to a minimum. If a test is to promote objectivity, it must itself be objective; and the teacher's judgment must be reduced to a minimum. "Objectivity is increased by the use of short-answer test questions such as simple-recall (in which one word will correctly answer the question), true-false, multiple-choice, and matching questions".<sup>2</sup> The following study is in order. "A geometry instructor had reproduced a geometry test paper handed in by one of his pupils and sent it to many mathematics teachers with the request that they rate it on a score

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<sup>1</sup>Jack C. Merwin and Eric F. Gardner, "Development and Applications of Tests of Educational Achievement", Review of Educational Research, Vol. 32, No. 1 (February, 1962), p. 42.

<sup>2</sup>Denis Baron and Harold W. Bernard, Evaluation Techniques for Classroom Teachers (New York: McGraw-Hill Book Company, Inc., 1958), p. 15.

of 100 points. The paper came back with grades ranging from 10 to 90."<sup>1</sup>

Objectivity is essential for the reliability and validity of a test. The two main factors that underlie objectivity are embedded in the scoring of the test, and the interpretation of the test items by the examinees.

The personal judgment (or bias) of the person who corrects the test should not influence the scores of the examinees. It is obvious that in the essay type of test, this personal judgment factor can hardly be eliminated altogether. Thus discrepancies in scoring are bound to take place.

The second aspect of objectivity deals with the students' interpretations of the items of the test. If the items of the test are well-constructed, they should lend themselves to one and only one meaning, at least to those who understand the material involved. In other words, any test item should mean essentially the same thing to those who know the point in question. The test items should be free from ambiguity, inconsistency, grammatical mistakes, and

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<sup>1</sup>Arthur E. Traxler and others, Introduction to Testing and the Use of Test Results in Public Schools (New York: Harper and Brothers, 1953), p. 8.

subjectivity, which may make the items unnecessarily difficult to understand or interpret.

4. Discrimination:

According to Micheels and Karnes<sup>1</sup>, a discriminative test should be constructed in such a way that it detects small differences in achievement. This is particularly essential if the test is to be used reliably for ranking students on the basis of achievement. To meet this purpose, three characteristics of the test must be present; these characteristics are:

a) The range of scores will be wide if the test is administered to students whose achievements actually differ significantly.

b) The test includes items at all levels of difficulty. In other words, the difficulty of the items ranges from the most difficult, which will be answered correctly only by the best students, to the so easy items that will be practically answered correctly by all the students.

c) Each item will discriminate between low and high groups of students as far as achievement is concerned. Each item will be missed more frequently

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<sup>1</sup>Micheels and Karnes, op.cit., pp. 118-121.



by poor students than by good ones.

5. Comprehensiveness:

Micheels and Karnes<sup>1</sup> believe that an achievement test should cover practically all phases of instruction. It may not be necessary, and even not practical, to include every point that is covered or taught in the course. Then, how comprehensive should a test be? A test should be comprehensive enough to be valid, i.e., the validity of a test is the criterion by which its comprehensiveness can be measured. There is no specific formula to apply for finding out whether a test is comprehensive or not - it is a matter of judgment.

B. Essay and Objective Tests:

Ebel<sup>2</sup> compares and contrasts essay and objective tests in the following way:

1. When to use either essay or objective tests

Essay and objective tests can be used to:

a) measure almost any important educational achievement.

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<sup>1</sup>Ibid., pp. 121-2.

<sup>2</sup>Robert L. Ebel, Measuring Educational Achievement (New Jersey: Prentice-Hall, Inc., 1965), pp. 84-110.

b) test understanding and ability for the command of knowledge, comprehension, and application of principles.

c) test ability in thinking critically.

d) test ability in solving novel problems.

e) test ability in selecting relevant facts and principles which could be integrated toward the solution of complex problems.

2. Some similarities between them:

Some of the similarities between essay and objective types of tests are the following:

a) Both are used to measure educational achievement.

b) Both can be used as an incentive for studying.

c) Either type involves the exercise of subjective judgment. In objective testing, the subjectivity is concentrated in the process of the construction of the test; in the essay type, the subjectivity is mainly manifested in the scoring of the answers.

d) In either type, the value of the scores depends on their objectivity and reliability.

3. Some differences between them:

The following chart shows some of the differences, in nature, between essay and objective types of tests.

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|  |   |
|--|---|
| 1. The testee plans his answer and expresses it in his own words.                              | 1. The testee chooses the answer from among given alternatives; or otherwise, the answer requires one or a few words. |
| 2. Essay tests consist of relatively few questions for which extended answers are expected.    | 2. Objective tests consist of many questions that require short answers.  |
| 3. The testee spends most of his time thinking and writing.                                    | 3. The testee spends most of his time thinking and reading.   |
| 4. Essay tests are relatively easy to prepare, but tedious and difficult to score objectively. | 4. Objective tests are relatively difficult to prepare, but easy to score objectively.                                |
| 5. The scores are controlled considerably by the grader.                                       | 5. The scores are determined almost entirely by the test.   |

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4. When to use essay tests:

In general, essay tests can be used when:

- a) the group to be tested is small; and the test

is not intended to be reused.

b) the teacher is particularly interested in finding out the students' attitudes rather than measuring their achievement.

c) the teacher is more confident in his proficiency in marking critically than in his ability to construct good objective items.

d) when the time available for preparing the test is short, whereas the time available for scoring is long.

e) the main purpose is the development of the skill of writing expression. Yet even when testing writing ability, objective tests could be used. "In a controlled experiment with college students, it was found that weekly essay tests did not produce significantly greater gains in writing ability than weekly objective tests."<sup>1</sup>

5. When to use objective tests:

Objective tests can be used when:

a) the group to be tested is large; and the test is intended to be reused.

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<sup>1</sup>R.L. Ebel and R.E. Hill, "Development and Applications of Tests of Educational Achievement", Review of Educational Research, Vol. 29, No. 1 (February, 1959), p. 43.

b) highly reliable scores are of vital importance, and must be obtained as efficiently as possible.

c) the teacher is more confident in his ability to construct good objective test items than in his ability to mark essay test answers objectively.

d) impartiality of evaluation, and absolute fairness are particularly essential.

e) there is more time pressure for marking the students' answers than for preparing the test.

## CHAPTER III

### PROCEDURE

#### A. Methodology of the Study:

The methods followed in this study consist of extensive analyses of data from the following sources:

- 1) literature pertaining to achievement tests;
- 2) the syllabi and textbooks of mathematics for the elementary and the intermediate schools in the Sudan;

- 3) past Intermediate Final Mathematics papers;

- 4) a pilot study; and

- 5) the students' answers to the two tests: one 'typical' of the prevailing Intermediate Final Mathematics, set by the head of the Department of Mathematics, Bakht er-Ruda, and the other, mainly of the objective type, set by the investigator. The study of the two tests includes:

- a) the correlation between the scores of students on the two types of tests.

- b) content validity, reliability, and item analysis of each of the two tests.

B. Design of the Sample:

The population of this study is the pupils (boys and girls) in the final grade of 1967/68 in Sudanese intermediate schools, both government and private.<sup>1</sup> The study was designed to be conducted on a representative sample of about 500 pupils from the above population. In the selection of this sample, the following factors have been taken into consideration:

- 1) the proportion of girls' intermediate schools to boys' intermediate schools;
- 2) the proportion of government intermediate schools to private intermediate schools; and
- 3) the appropriate representation of different parts of the Sudan.

The designed sample consists of:

- 1) six classes from government boys' intermediate schools,
- 2) two classes from private boys' intermediate schools,
- 3) one class from a government girls' intermediate school, and

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<sup>1</sup>A private school means a non-government school which follows the government system and whose pupils sit for the Intermediate Final Examinations.

4) one class from a private girls' intermediate school.

The above stratification of the sample shows the proportion of government to private schools, and the proportion of boys' to girls' schools. The representation of the different parts of the Sudan, in the sample is as follows:

- 1) two classes from Eastern Sudan,
- 2) one class from Western Sudan,
- 3) one class from Northern Sudan,
- 4) four classes from Central Sudan, and
- 5) two classes from Southern Central Sudan.

C. Correspondence:

1. Bakht er-Ruda

To eliminate the element of bias in the study, the 'typical' prevailing Intermediate Final Mathematics had to be set by a person other than the writer, since the writer had to construct a suggested type to replace it. The head of the Department of Mathematics, Bakht er-Ruda, who is actually responsible for setting the Intermediate Final Mathematics, was asked to write such a test. He has kindly acted on the writer's request; and a copy of this 'typical' Intermediate Final Mathematics is in Appendix D.



## 2. Intermediate Schools

The selection of the sample has been followed by duplicate letters to the headmasters of the intermediate schools selected. The content of each letter were:

- a) a synopsis of the study,
- b) the information needed by the writer for his study,
- c) an outline of the procedure of conducting the tests, and
- d) a request of the approval of including their schools in the study.

The reader can refer to a copy of this letter in Appendix A.

The writer had secured the approval of all the headmasters and the headmistresses of the schools which comprise the sample initially selected.

Although tests were sent to the ten selected classes of which the sample consists, yet only the manuscripts of four of these classes have been received. Fortunately, these four schools are from four different parts of the Sudan: Eastern, Central, Western, and Southern Central Sudan. And, at the same time, they represent the four categories of intermediate schools, namely, boys (government and private), and girls (government and private). Thus, even though

the actual sample used was cut from 500 to 115, it is nevertheless sufficiently representative of the intermediate schools to provide a good basis for a first study of this sort.

D. Steps for Constructing the Test:

An effective program of study has specific, well-defined objectives which are usually expressed in terms of concepts, skills, and attitudes to be acquired by the students. A good measuring or evaluating device can determine the extent to which these objectives are realized. The investigator had to decide what was to be measured taking into consideration the necessity of determining the 'what' in clear, unmistakable terms.

The following were the main steps taken for constructing the test:<sup>1</sup>

1) The major objectives were listed for which an appraisal was desired.

2) The course content was examined for additional objectives. This step was actually part of the first one. It was a checking step to ascertain that all the significant objectives were being considered. The purpose of each topic or unit was then determined by constantly asking: What is the purpose

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<sup>1</sup>Micheels and Karnes, pp. 92-98.

of this topic or unit? What should the student get from the topic or unit under consideration?

3) Each objective was analyzed and defined in terms of expected student outcomes. The various elements that constitute each objective were listed. It was aimed at that the test would be fair to all the students by really showing the extent each has achieved. The purpose of this step is to give meaning to each objective and to list the elements contained in it. When this analysis was completed, it formed the basis for a complete program of evaluation.

4) Finally, a table of specifications, for the test, was established. This table served as a guide; it was similar to a blueprint. Its function was to specify the emphasis that was to be given to each objective being measured. This table facilitated the construction of the actual items.

#### E. Planning and Preparing the Suggested Test:

##### 1. A basic assumption of the Study:

A basic assumption underlying this study is that the prevailing Intermediate Final Mathematics needs considerable improvement, particularly as far as reliability, objectivity, and validity are concerned. In order to verify this assumption a 'typical'

Intermediate Final Mathematics (set by the head of the Department of Mathematics, Bakht er-Ruda) and a suggested substitute (set by the investigator) were given to a representative sample of pupils in the final grade of 1967/68 in Sudanese intermediate schools. The results of these tests will furnish the basic data for the study.

## 2. Planning the Test:

The writer had thoroughly studied the textbooks, as well as the teachers' handbooks, of mathematics for both the elementary and the intermediate schools. The major objectives have been determined, and the concepts isolated. These concepts and objectives were tested on three levels of understanding: knowledge, comprehension, and application. Bloom's "Taxonomy of Educational Objectives"<sup>1</sup> has been consulted for defining these levels of understanding.

a) Knowledge: Knowledge includes test situations which are very similar to the original learning situations. The examinees are expected to

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<sup>1</sup>Benjamin S. Bloom and Others, Taxonomy of Educational Objectives (New York: David McKay Company, Inc., 1956), pp. 62-143.

answer questions or solve problems similar to those presented in the textbooks. "The knowledge category differs from the others in that remembering is the major psychological process involved here, while in the other categories the remembering is only one part of a much more complex process of relating, judging, and reorganizing".<sup>1</sup>

Testing for knowledge: "The major behavior tested in knowledge is whether or not the student can remember or either cite or recognize accurate statements in response to particular questions. Although somewhat more than rote memory is required for knowledge, the form of the question and the level of precision and exactness required should not be too different from the way in which the knowledge was originally learned."<sup>2</sup>

b) Comprehension: Comprehension includes responses which represent understanding of concepts and objectives. To achieve this understanding, the student may change the concept in his mind to some parallel form more meaningful to him. There may also be responses which represent simple extensions beyond

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<sup>1</sup>Ibid., p. 62.

<sup>2</sup>Ibid., p. 78.

what is given in the test item itself.

Three types of comprehension are considered.

These are:

i) Translation: Translation means the transformation of a symbolic form to another form. It is the ability to translate relationships expressed in symbolic form, including graphs and mathematical formulae, to verbal form and vice versa. Translation includes the ability to prepare graphical representations of a given data. It also includes the ability to translate geometric concepts, given in verbal terms, into visual or spacial terms.

If an item is to be of a level transcending knowledge, the context in which the terms or symbols appear must be to some extent novel. The nature of the previous instruction, rather than the appearance of the item, is the deciding factor.

ii) Interpretation: Interpretation "involves dealing with a communication as a configuration of ideas whose comprehension may require a reordering of the ideas into a new configuration in the mind of the individual. This also includes thinking about the relative importance of the ideas, their interrelationships, and their relevance to generalizations implied or described in the original communication. Evidence

of interpretation behavior may be found in the inferences, generalizations, or summarizations produced by the individual".<sup>1</sup>

When evaluating interpretation ability, the examinee is presented with a situation and is asked to make inferences which may be drawn from the communication. "The inferences may be at a more general level than the communication itself, and should, where possible, be based on more than one element in the communication. Sometimes, the inferences may represent generalizations based on particulars given in the communication, or may pertain to particulars to which generalizations given in the communication apply."<sup>2</sup>

iii) Extrapolation: This is the third type of comprehension. It includes the making of estimates or predictions. It may also involve the making of inferences with respect to implications, consequences, corollaries and effects which are in accordance with the conditions described in the communication.

The questions on extrapolation attempt to determine whether or not the examinee can go beyond the limits of the data or information given and make

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<sup>1</sup>Ibid., p. 90.

<sup>2</sup>Ibid., p. 106.

correct applications and extensions of the data or information.

c) Application: A necessary (and yet not sufficient) condition for application is the comprehension of the method, theory, principle, or abstraction applied. "A problem in the comprehension category requires the student to know an abstraction well enough that he can correctly demonstrate its use when specifically asked to do so. 'Application', however, requires a step beyond this. Given a problem new to the student, he will apply the appropriate abstraction without having to be prompted as to which abstraction is correct or without having to be shown how to use it in that situation. A demonstration of 'Comprehension' shows that the student can use the abstraction when its use is specified. A demonstration of 'Application' shows that he will use it correctly, given an appropriate situation in which no mode of solution is specified."<sup>1</sup>

When testing application, the testing situation must be new to the examinee, or it must contain new elements as compared to the situation in which the abstraction was learned. This might mean that

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<sup>1</sup>Ibid., p. 120.



the problem can be known to the examinee but presented in such a way that he is unlikely to have thought of it previously.

### 3. Preparing the Test:

The time for the suggested test was fixed in accordance with the scheduled time for the Intermediate Final Mathematics, which is two hours. The test consisted of sixty items - twenty items on each of the three levels of understanding. Table 2 shows the distribution of the items over the concepts and the three levels of understanding.

The test consists of thirty-five multiple-choice items, and twenty-five short open-ended questions. The answers to all questions are to be shown on the examination booklet which is preceded by a page of "Directions". The comprehensiveness of the test is sought through its content validity. The reader is referred to Appendix E for a copy of this test (in Arabic).

### The Practice Test:

A practice test, following the same style of the suggested examination, intended to train the students for this relatively 'new' type of test, was constructed. This practice test consists of twenty

questions. A copy of this test is found in Appendix C.

TABLE 2

CONCEPTS AND LEVELS OF UNDERSTANDING TESTED

| Concepts                    | Knowl-<br>edge | Compre-<br>hension | Applica-<br>tion | Number<br>of<br>Items |
|-----------------------------|----------------|--------------------|------------------|-----------------------|
| The four rules              |                | 3,5                |                  | 2                     |
| Common fractions            | 4              | 10                 |                  | 2                     |
| Decimals                    | 2,36           |                    |                  | 2                     |
| Arithmetic mean             |                | 19                 |                  | 1                     |
| Area                        | 15,28          |                    | 24               | 3                     |
| Volume                      | 33             |                    | 40               | 2                     |
| Ratio and proportion        |                |                    | 20,32            | 2                     |
| Percentage                  | 39             |                    | 25,34            | 3                     |
| Roots                       | 9,41           |                    |                  | 2                     |
| Logarithms (and<br>indices) |                | 13,17              |                  | 2                     |
| Angles                      | 7              |                    | 31               | 2                     |
| Congruency                  | 21             | 22                 |                  | 2                     |
| Locus                       | 29,35,52       |                    |                  | 3                     |
| Parallel lines              |                |                    | 49               | 1                     |
| Directed numbers            | 18             |                    |                  | 1                     |
| Equations                   |                | 47                 | 43,50            | 3                     |
| Formulae                    |                |                    | 45,46            | 2                     |

TABLE 2 (Continued)

| Concepts                                 | Knowl-<br>edge | Compre-<br>hension | Applica-<br>tion | Number<br>of<br>Items |
|--|----------------|--------------------|------------------|-----------------------|
| Graphs                                   | 54             | 55-60              |                  | 7                     |
| Similar figures                          |                | 23                 |                  | 1                     |
| Algebraic expressions                    | 48             | 53                 |                  | 2                     |
| Factors                                  |                | 1                  |                  | 1                     |
| Scale                                    |                | 11,12              |                  | 2                     |
| Identities                               |                |                    | 8,42             | 2                     |
| Geometric figures                        |                |                    | 30               | 1                     |
| Tangent of an angle                      | 14             |                    | 44               | 2                     |
| Angles of elevation<br>and of depression |                | 51                 |                  | 1                     |
| Prime numbers                            | 6              |                    |                  | 1                     |
| Bearing                                  | 38             |                    |                  | 1                     |
| Calendar                                 |                |                    | 37               |                       |
| Perimeter                                |                |                    | 26,27            | 2                     |
| Time, distance, speed                    |                |                    | 16               | 1                     |
|  | 20             | 20                 | 20               | 60                    |

F. The Pilot Study:

A pilot study was conducted on a boys' government class in Omdurman, Sudan. Although the examination papers were sent ahead of time from Beirut to the Sudan and back to Beirut by registered air mail, yet an unexpected delay, of about a month, took place. As a result of this delay the examination papers had to be sent to the sample schools before the results from the pilot study were analyzed. However, the analysis of these results revealed that no significant changes had to be made in the items. The results and item analysis of the pilot study appear in tables 3 and 4.<sup>1</sup>

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<sup>1</sup>Assignment to top and bottom groups is by total test score, thus making discrimination values an estimate of internal consistency.

TABLE 3

PILOT STUDY: DISTRIBUTION OF SCORES

| Scores  | f  |
|---------|----|
| 72 - 74 | 2  |
| 69 - 71 | 0  |
| 66 - 68 | 4  |
| 63 - 65 | 4  |
| 60 - 62 | 2  |
| 57 - 59 | 4  |
| 54 - 56 | 6  |
| 51 - 53 | 2  |
| 48 - 50 | 4  |
| 45 - 47 | 2  |
| 42 - 44 | 4  |
| 39 - 41 | 3  |
| 36 - 38 | 1  |
| 33 - 35 | 3  |
| 30 - 32 | 0  |
| 27 - 29 | 1  |
| 24 - 26 | 1  |
| 21 - 23 | 2  |
|         | 45 |

Maximum Possible Score = 88. Mean = 50.42.

Standard Deviation = 13.30. Range = 51.

TABLE 4

PILOT STUDY: DIFFICULTY AND DISCRIMINATION

| Item Number | Degree of Difficulty (%) | Level of Discrimination | Item Number | Degree of Difficulty (%) | Level of Discrimination |
|-------------|--------------------------|-------------------------|-------------|--------------------------|-------------------------|
| 1           | 90                       | .20                     | 20          | 90                       | .20                     |
| 2           | 60                       | .20                     | 21          | 50                       | .80                     |
| 3           | 75                       | .50                     | 22          | 80                       | .40                     |
| 4           | 60                       | .60                     | 23          | 25                       | .10                     |
| 5           | 80                       | .20                     | 24          | 40                       | .60                     |
| 6           | 50                       | .20                     | 25          | 80                       | .40                     |
| 7           | 65                       | .70                     | 26          | 65                       | .70                     |
| 8           | 95                       | .10                     | 27          | 35                       | .30                     |
| 9           | 95                       | .10                     | 28          | 55                       | .30                     |
| 10          | 50                       | .40                     | 29          | 65                       | .70                     |
| 11          | 40                       | .40                     | 30          | 80                       | .40                     |
| 12          | 0                        | .00                     | 31          | 45                       | .70                     |
| 13          | 75                       | .50                     | 32          | 45                       | .30                     |
| 14          | 80                       | .40                     | 33          | 25                       | .10                     |
| 15          | 55                       | .90                     | 34          | 15                       | .30                     |
| 16          | 85                       | .30                     | 35          | 50                       | .60                     |
| 17          | 15                       | .30                     | 36          | 85                       | .10                     |
| 18          | 70                       | .20                     | 37          | 25                       | .50                     |
| 19          | 65                       | .10                     | 38          | 40                       | .80                     |

TABLE 4  
(Cont'd)

| Item Number | Degree of Difficulty (%) | Level of Discrimination | Item Number | Degree of Difficulty (%) | Level of Discrimination |
|-------------|--------------------------|-------------------------|-------------|--------------------------|-------------------------|
| 39          | 85                       | .30                     | 50          | 50                       | .60                     |
| 40          | 75                       | .10                     | 51          | 45                       | .90                     |
| 41          | 30                       | .40                     | 52          | 70                       | .40                     |
| 42          | 70                       | .40                     | 53          | 50                       | .40                     |
| 43          | 50                       | .80                     | 54          | 80                       | .20                     |
| 44          | 45                       | .50                     | 55          | 35                       | .70                     |
| 45          | 80                       | .20                     | 56          | 35                       | .70                     |
| 46          | 10                       | .20                     | 57          | 30                       | .40                     |
| 47          | 75                       | .50                     | 58          | 55                       | .30                     |
| 48          | 55                       | .90                     | 59          | 90                       | .20                     |
| 49          | 90                       | .20                     | 60          | 40                       | .40                     |

G. Procedure of Conducting the Tests:

The followings were sent by registered air mail to the headmasters and headmistresses of the intermediate schools selected:

- 1) A 'typical' Intermediate Final Mathematics - for reference called 'Test 1';
- 2) A practice objective test - called 'Test 2';

- 3) The suggested objective test - called 'Test 3';
  - 4) Examination answer-books for 'Test 1';
  - 5) The 'Directions' for conducting the tests.
- (A copy of these 'Directions' is found in Appendix B).

In the 'Directions', the headmasters and the headmistresses were strongly asked to adhere literally to the procedure of conducting the tests given below:

#### Order of Giving the Tests

First, 'Test 1'

Second, 'Test 2'

Third, 'Test 3'

#### Procedure of the Tests

The followings are the procedures for each test requested to be followed carefully.

a) Test 1

i) This test is a 'typical' Intermediate Final Mathematics. It consists of eight questions.

ii) Time: Two hours.

iii) This test should be answered on the answer-books especially designed for this test.

iv) Each student should start the test by writing his name and the name of his school in the indicated place at the top of the answer-book.



v) Before collecting the answer-books, the supervisor is strongly asked to check that every student has written his name and the name of his school.

vi) The students can keep the question papers.

vii) Kindly send the answer-books - without scoring them - by registered air mail

b) 'Test 2'

i) This test consists of twenty items.

ii) The purpose of this test is to prepare the students for taking 'Test 3'.

iii) This test is similar, in form, to 'Test 3'.

iv) The 'Directions' (the first page), which accompany this test are the same 'Directions' for 'Test 3'.

v) Will the supervisor kindly read and discuss the 'Directions' with the students.

vi) Time: Not limited.

vii) This test is to be answered on the same examination booklet.

viii) The students can be helped in the procedure of expressing their answers.

ix) Will the supervisor kindly train the students to use their examination booklets properly.

x) Will the mathematics teacher kindly

score this test, and give the papers back to the students. It is necessary that every student master the way this test is answered.

xi) The students can keep their papers with them.

c) 'Test 3'

i) This test consists of sixty items.

ii) The distance between any two adjacent students should be, at least, one metre.

iii) Will the supervisor read the 'Directions' (the first page) with the students, and answer the questions pertaining to the 'Directions' only.

iv) The time for this test (excluding the time taken by the 'Directions') is two hours.

v) This test is to be answered on the same examination booklet.

vi) Each student should write his name and the name of his school in the indicated place at the top of the examination booklet.

vii) Will the supervisor remind the students to use their examination booklets in the proper manner they have learned from 'Test 2'.

viii) No questions of any type are allowed during the examination.

ix) Before collecting the examination booklets, will the supervisor make sure that every student has written his name and the name of his school.

x) Kindly send the examination booklets - without scoring them - by registered air mail.

#### H. Scoring the Tests:

The scoring plan of the 'typical' Intermediate Final Mathematics was prepared by the setter of the test, the head of the Department of Mathematics, Bakht er-Ruda; and the scoring plan for the suggested objective test was prepared by the investigator. The reader is referred to Appendix F for the scoring plan of the first test, and to Appendix D for the scoring plan of the second test.

The two tests were marked by both Mr. Umar Ballal (M.A.) and the writer after they agreed to follow the scoring plans as closely as possible.

#### I. Analysis of Data:

##### 1. Validity and Comprehensiveness:

The mathematics syllabus for the intermediate schools, in the Sudan, consists of thirty-one concepts as shows in Table 2.

The appropriate representation of these concepts in an Intermediate Final Mathematics determines

the content validity, and hence the comprehensiveness of that examination.

2. Reliability:

a) The 'typical' Intermediate Final Mathematics:

For estimating the reliability of this test, the eighty-five steps, which comprise the solution of the eight questions, were considered as items. The Kuder-Richardson formula number 20, adapted by P.L. Dressel, and called Dressel's formula<sup>1</sup> was used. This formula is:

$$r_{tt} = \left( \frac{n}{n-1} \right) \left( \frac{\sigma_t^2 - \frac{\sum w_i^2 p_i q_i}{n}}{\sigma_t^2} \right)$$

where,  $r_{tt}$  = Reliability of the total test;

$n$  = Number of items in the test;

$p$  = Proportion of correct responses to each item;

$q$  =  $1 - p$  ;

$\sigma_t$  = Standard deviation of total scores;

$w$  = Weight assigned to each item.

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<sup>1</sup>J.P. Guilford, Psychometric Methods (New York: McGraw-Hill Book Company, Inc., 1954), p. 383.

b) Suggested Test:

To render the estimation of reliability possible, eight items were split into eighteen items, as they are thus scored. This raised the number of items from sixty to seventy. Here, also Dressel's formula was applied.

The reliability of this test was also found by the Split-Half Method<sup>1</sup>, applying the formula:

$$r_{tt} = \frac{2r_{oe}}{1+r_{oe}}$$

where,  $r_{tt}$  = Reliability of original test;

$r_{oe}$  = Reliability coefficient obtained by correlating the scores of the odd items with the scores of the even items.

3. Difficulty and Discrimination:

For both tests, the top thirty papers (about 26% of the sample<sup>2</sup>) and the bottom thirty papers were taken to represent the high and low groups respectively.

a) Degree of Difficulty:

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<sup>1</sup>N.M. Downie and R.W. Heath, Basic Statistical Methods (2nd ed.; New York: Harper and Row, Publishers, 1965), pp. 217-218.

<sup>2</sup>Ordinarily between 25% and 30% of the sample is used for each of the top and bottom groups.

The degree of difficulty (D.D.) of each item of both tests was estimated by using the formula

$$D.D. = \frac{\sum H + \sum L}{2NM}$$

where,  $\sum H$  = Sum of scores obtained by the high group in each question;

$\sum L$  = Sum of scores obtained by the low group in that question;

$N$  = Number of students in high (or low) group;

$M$  = Maximum possible score for the question.

b) Level of Discrimination

The level of discrimination (L.D.) of each item in both tests was found by applying the formula:

$$L.D. = \frac{\sum H - \sum L}{NM}$$

where the symbols  $\sum$ ,  $H$ ,  $L$ ,  $N$ , and  $M$  have the same meaning expressed above.

4. Objectivity:

For estimating the objectivity of scoring, both tests were scored by Mr. Umar Ballal (M.A.) and the investigator. Mr. Ballal had taken part in marking the Intermediate Final Mathematics for some years.

The degree of objectivity was taken to be the correlation between the scores of both graders.

## CHAPTER IV

### RESULTS

#### A. Validity and Comprehensiveness:

##### 1. The 'typical' Intermediate Final Mathematics:

Students are not tested in half of the concepts (listed in Table 2). Specifically, the test does not measure achievement in these concepts: arithmetic mean, volume, logarithms (note that question 8, part A can be done without using logarithms), congruency, similar figures, factors, identities, angles of elevation and depression, prime numbers, bearing, calendar, perimeter, and time, distance, speed.

The failure to include most (if not all) of the concepts may be mainly due to the nature of the test which does not lend itself to be comprehensive with high content validity.

##### 2. The Suggested Test:

This test is so constructed that all the mathematical concepts, assigned for the intermediate school mathematics, are well represented. These concepts are tested on three levels of understanding:

knowledge, comprehension, and application.

3. Previous Papers of the Intermediate Final Mathematics:

Table 5 shows the missing concepts in five past papers of the Intermediate Final Mathematics.

TABLE 5  
MISSING CONCEPTS IN FIVE PAST INTERMEDIATE  
FINAL MATHEMATICS PAPERS

| 1962                               | 1964             | 1965                               | 1966                               | 1967                               |
|------------------------------------|------------------|------------------------------------|------------------------------------|------------------------------------|
| Formulae                           | Common Fractions | Arithmetic mean                    | Arithmetic mean                    | Arithmetic mean                    |
| Similar figures                    | Arithmetic mean  | Volume                             | Volume                             | Parallel lines                     |
| Factors                            | Parallel lines   | Roots                              | Congruency                         | Similar figures                    |
| Identities                         | Similar figures  | Similar figures                    | Similar figures                    | Factors                            |
| Angles of elevation and depression | Factors          | Factors                            | Identities                         | Angles of elevation and depression |
| Prime numbers                      | Prime numbers    | Angles of elevation and depression | Angles of elevation and depression | Prime numbers                      |
| Calendar                           | Bearing          | Calendar                           | Prime numbers                      | Bearing                            |
| Perimeter                          | Calendar         | Prime numbers                      | Prime numbers                      | Calendar                           |
| Time, distance, speed              | Perimeter        | Bearing                            | Bearing                            | Time, distance, speed              |
|                                    |                  | Calendar                           | Calendar                           |                                    |
|                                    |                  | Perimeter                          | Time, Distance, speed              |                                    |
|                                    |                  | Time, distance, speed              | Common fractions                   |                                    |



B. Reliability of the Two Tests:

1. 'Typical' Intermediate Final Mathematics:

Substituting the calculated values of

$\sum_{i=1}^{85} w_i^2 p_i q_i$  (= 28.89),  $\sigma_t^2 = 428.71$ ,  $n = 85$  in Dressel's formula, the reliability of the total test,  $r_{tt}$ , is

$$\begin{aligned} r_{tt} &= \left( \frac{n}{n-1} \right) \left( \frac{\sigma_t^2 - \sum w_i^2 p_i q_i}{\sigma_t^2} \right) \\ &= \left( \frac{85}{85-1} \right) \left( \frac{428.71 - 28.89}{428.71} \right) = \frac{85}{84} \times \frac{399.82}{428.71} = .94 \end{aligned}$$

2. Suggested Objective Test:

Here,  $\sum_{i=1}^{70} w_i^2 p_i q_i = 25.61$ ,  $\sigma_t^2 = 263.44$ ,

$n = 70$ ; thus

$$r_{tt} = \left( \frac{70}{70-1} \right) \left( \frac{263.44 - 25.61}{263.44} \right) = \frac{70}{69} \times \frac{237.83}{263.44} = .91$$

The Split-Half Method gave the same  $r_{tt} = .91$  as is evident from substituting the obtained value of  $r_{oe} = .83$  in the formula

$$\begin{aligned} r_{tt} &= \frac{2 r_{oe}}{1 + r_{oe}} \\ &= \frac{2 \times .83}{1 + .83} = \frac{1.66}{1.83} = .91 \end{aligned}$$

Theoretically lengthening this test to 85 items, the reliability coefficient can be predicted using

Spearman-Brown prophecy formula<sup>1</sup>:

$$r_{tt} = \frac{N^2 r}{1 + (N^2 - 1)r}$$

where  $N^2$  = the number of times the test is longer or shorter than the original test

$r$  = the reliability of the test which is being lengthened or shortened.

Thus,

$$r_{tt} = \frac{\left(\frac{85}{70}\right) (.91)}{1 + \left(\frac{85}{70} - 1\right) (.91)} = \frac{1.14 \times .91}{1 + .14 \times .91} = \frac{1.0374}{1.1274} = .92$$

3. Comparison of the Two Reliabilities:

The difference between the two reliabilities (.94 - .91 = .03) is not significant.<sup>2</sup> Hence, in general, the two tests are equally reliable.

C. Difficulty and Discrimination:<sup>3</sup>

1. 'Typical' Intermediate Final Mathematics:

The degree of difficulty and level of discrimination for the eight questions are shown in Table 6.

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<sup>1</sup>Downie and Heath, pp. 218-219.

<sup>2</sup>While it may appear surprising that an "essay" test should thus be on a par with an objective test, it should be remembered that the "essay" was in fact subdivided into 85 objectively scored "items".

<sup>3</sup>See footnote on p. 41.

TABLE 6

TYPICAL INTERMEDIATE FINAL MATHEMATICS:  
DIFFICULTY AND DISCRIMINATION<sup>1</sup>

| Question Number | $\Sigma H$ | $\Sigma L$ | Maximum possible Score | Degree of Difficulty (%) | Level of Discrimination |
|-----------------|------------|------------|------------------------|--------------------------|-------------------------|
| 1               | 303        | 92         | 15                     | 44                       | 0.47                    |
| 2               | 410        | 90         | 14                     | 60                       | 0.79                    |
| 3               | 229        | 103        | 10                     | 55                       | 0.42                    |
| 4               | 31         | 2          | 12                     | 5                        | 0.08                    |
| 5               | 267        | 74         | 10                     | 57                       | 0.64                    |
| 6               | 287        | 52         | 12                     | 47                       | 0.65                    |
| 7               | 273        | 2          | 13                     | 35                       | 0.69                    |
| 8               | 374        | 181        | 14                     | 66                       | 0.46                    |

2. Suggested Objective Test:

Table 7 shows the degree of difficulty and level of discrimination of each item.

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<sup>1</sup> See footnote on p. 41.

TABLE 7

SUGGESTED TEST: DIFFICULTY AND DISCRIMINATION

| Item Number | H  | L  | Maximum Possible Score | Difficulty (%) | Discrimination | Item Number | H  | L  | Maximum Possible Score | Difficulty (%) | Discrimination |
|-------------|----|----|------------------------|----------------|----------------|-------------|----|----|------------------------|----------------|----------------|
| 1           | 30 | 26 | 1                      | 93             | .13            | 31          | 52 | 22 | 2                      | 62             | .50            |
| 2           | 25 | 9  | 1                      | 57             | .53            | 32          | 38 | 10 | 2                      | 40             | .47            |
| 3           | 29 | 17 | 1                      | 77             | .40            | 33          | 34 | 10 | 2                      | 37             | .40            |
| 4           | 29 | 16 | 1                      | 75             | .43            | 34          | 16 | 2  | 2                      | 15             | .23            |
| 5           | 23 | 12 | 1                      | 58             | .43            | 35          | 46 | 20 | 2                      | 55             | .43            |
| 6           | 25 | 17 | 1                      | 70             | .27            | 36          | 28 | 11 | 1                      | 65             | .57            |
| 7           | 25 | 17 | 1                      | 70             | .27            | 37          | 5  | 6  | 1                      | 18             | -.03           |
| 8           | 29 | 22 | 1                      | 85             | .23            | 38          | 16 | 2  | 1                      | 30             | .47            |
| 9           | 30 | 21 | 1                      | 85             | .30            | 39          | 29 | 21 | 1                      | 83             | .23            |
| 10          | 22 | 13 | 1                      | 58             | .30            | 40          | 29 | 8  | 1                      | 62             | .70            |
| 11          | 21 | 4  | 1                      | 42             | .57            | 41          | 20 | 12 | 1                      | 53             | .27            |
| 12          | 0  | 2  | 1                      | 3              | -.07           | 42          | 22 | 11 | 1                      | 55             | .37            |
| 13          | 29 | 11 | 1                      | 67             | .60            | 43          | 25 | 13 | 1                      | 63             | .40            |
| 14          | 29 | 15 | 1                      | 73             | .47            | 44          | 30 | 15 | 1                      | 75             | .50            |
| 15          | 30 | 20 | 1                      | 83             | .33            | 45          | 29 | 12 | 1                      | 68             | .57            |
| 16          | 28 | 15 | 1                      | 72             | .33            | 46          | 14 | 0  | 2                      | 12             | .23            |
| 17          | 14 | 6  | 1                      | 33             | .27            | 47          | 55 | 30 | 2                      | 71             | .42            |
| 18          | 25 | 15 | 1                      | 67             | .33            | 48          | 48 | 22 | 2                      | 58             | .43            |
| 19          | 25 | 19 | 1                      | 73             | .20            | 49          | 44 | 20 | 2                      | 53             | .40            |
| 20          | 29 | 25 | 1                      | 90             | .13            | 50          | 55 | 27 | 2                      | 68             | .47            |
| 21          | 22 | 11 | 1                      | 55             | .37            | 51          | 50 | 10 | 2                      | 50             | .67            |
| 22          | 30 | 27 | 1                      | 95             | .10            | 52          | 52 | 16 | 2                      | 57             | .60            |
| 23          | 40 | 24 | 2                      | 53             | .27            | 53          | 47 | 21 | 2                      | 57             | .43            |
| 24          | 38 | 16 | 2                      | 45             | .37            | 54          | 59 | 58 | 2                      | 98             | .02            |
| 25          | 56 | 26 | 2                      | 68             | .50            | 55          | 49 | 17 | 2                      | 55             | .53            |
| 26          | 50 | 22 | 2                      | 60             | .47            | 56          | 48 | 14 | 2                      | 52             | .57            |
| 27          | 26 | 20 | 2                      | 38             | .10            | 57          | 47 | 17 | 2                      | 53             | .50            |
| 28          | 48 | 22 | 2                      | 58             | .43            | 58          | 54 | 24 | 2                      | 65             | .50            |
| 29          | 50 | 22 | 2                      | 60             | .47            | 59          | 60 | 44 | 2                      | 87             | .28            |
| 30          | 50 | 22 | 2                      | 60             | .47            | 60          | 44 | 14 | 2                      | 48             | .50            |

3. Analysis of Results:

a) 'Typical' Intermediate Final Mathematics:

With the exception of question four, the indices of difficulty and discrimination are significant. Yet it must be pointed out that question four weighs 12% of the whole test.

b) Suggested Test:

It can be seen from Table 7 that items 1, 3, 6, 7, 8, 9, 15, 16, 18, 19, 20, 22, 39, and 54 are fairly easy, and attempted by over 70% of the students. At the same time, some items do discriminate between the able and the less able students. Among such items are 11, 13, 25, 31, 36, 40, 45, 51, 52, 55, 56, 57, 58, and 60.

Items 12 and 37 were too difficult even for the top group, and thus had poor indices of difficulty and discrimination. But these two items weigh about 3% of the total score of the entire test.

In general, one may safely say that most of the items yielded acceptable indices of difficulty and discrimination.

D. Objectivity:

The correlation of the scores of both markers for each test was found to be .99. This shows that

the scoring of both tests is highly objective, as well as, there is no difference in objectivity of scoring both tests. This may be due to the fact that the marking plans are very straightforward.

E. Correlations:

It can readily be seen from Table 8 that the correlations between the scores of the 'typical' Intermediate Final Mathematics and <sup>the</sup> objective subscores on knowledge, comprehension, application are close enough to conclude that the performance of the students in the suggested objective test has not yielded appreciable difference between these three levels of understanding. Again, the differences in correlation between knowledge, comprehension, application - each two taken at a time - are not significant. Yet scores on knowledge correlate relatively low with scores on comprehension; and the correlation between knowledge and application is still lower. Incidentally, <sup>at</sup> the correlation between comprehension and application was found to be the same as the correlation between knowledge and comprehension.

In general, those who scored high in the 'typical' Intermediate Final Mathematics scored high in the suggested test and vice versa; however, there were some exceptions.

TABLE 8

CORRELATIONS

|  | Suggested Objective Test: Total Score | Knowledge Subscore | Comprehension Subscore | Application Subscore |
|--|---------------------------------------|--------------------|------------------------|----------------------|
| Typical Intermediate Final Mathematics Total Score | .84                                   | .75                | .71                    | .78                  |
| Suggested Objective Test Total Score               |                                       | .86 <sup>★</sup>   | .90 <sup>★</sup>       | .89 <sup>★</sup>     |
| Knowledge Subscore                                 |                                       |                    | .69                    | .65                  |
| Comprehension Subscore                             |                                       |                    |                        | .69                  |

★ Artificially inflated due to the inclusion of each subscore in each total-score.

F. Distribution of Scores:

The distribution of the scores of both tests is given in Table 9. The scores in this table are plotted in the frequency polygons that follow it.

TABLE 9

DISTRIBUTION OF SCORES OF BOTH TESTS

| Typical Intermediate<br>Final Mathematics |                | Suggested Objective<br>Test |                |
|---|----------------|-----------------------------|----------------|
| Scores                                    | Frequency<br>f | Scores                      | Frequency<br>f |
| 85-89                                     | 2              | 80-84                       | 1              |
| 80-84                                     | 4              | 75-79                       | 6              |
| 75-79                                     | 7              | 70-74                       | 7              |
| 70-74                                     | 4              | 65-69                       | 6              |
| 65-69                                     | 5              | 60-64                       | 15             |
| 60-64                                     | 10             | 55-59                       | 14             |
| 55-59                                     | 10             | 50-54                       | 13             |
| 50-54                                     | 12             | 45-49                       | 16             |
| 45-49                                     | 10             | 40-44                       | 19             |
| 40-44                                     | 12             | 35-39                       | 7              |
| 35-39                                     | 7              | 30-34                       | 3              |
| 30-34                                     | 10             | 25-29                       | 4              |
| 25-29                                     | 5              | 20-24                       | 0              |
| 20-24                                     | 1              | 15-19                       | 3              |
| 15-19                                     | 3              | 10-14                       | 1              |
| 10-14                                     | 10             |                             |                |
| 05-09                                     | 2              |                             | f=115          |
| 00-04                                     | 1              |                             |                |
|   | f=115          |                             |                |

Mean = 46.75

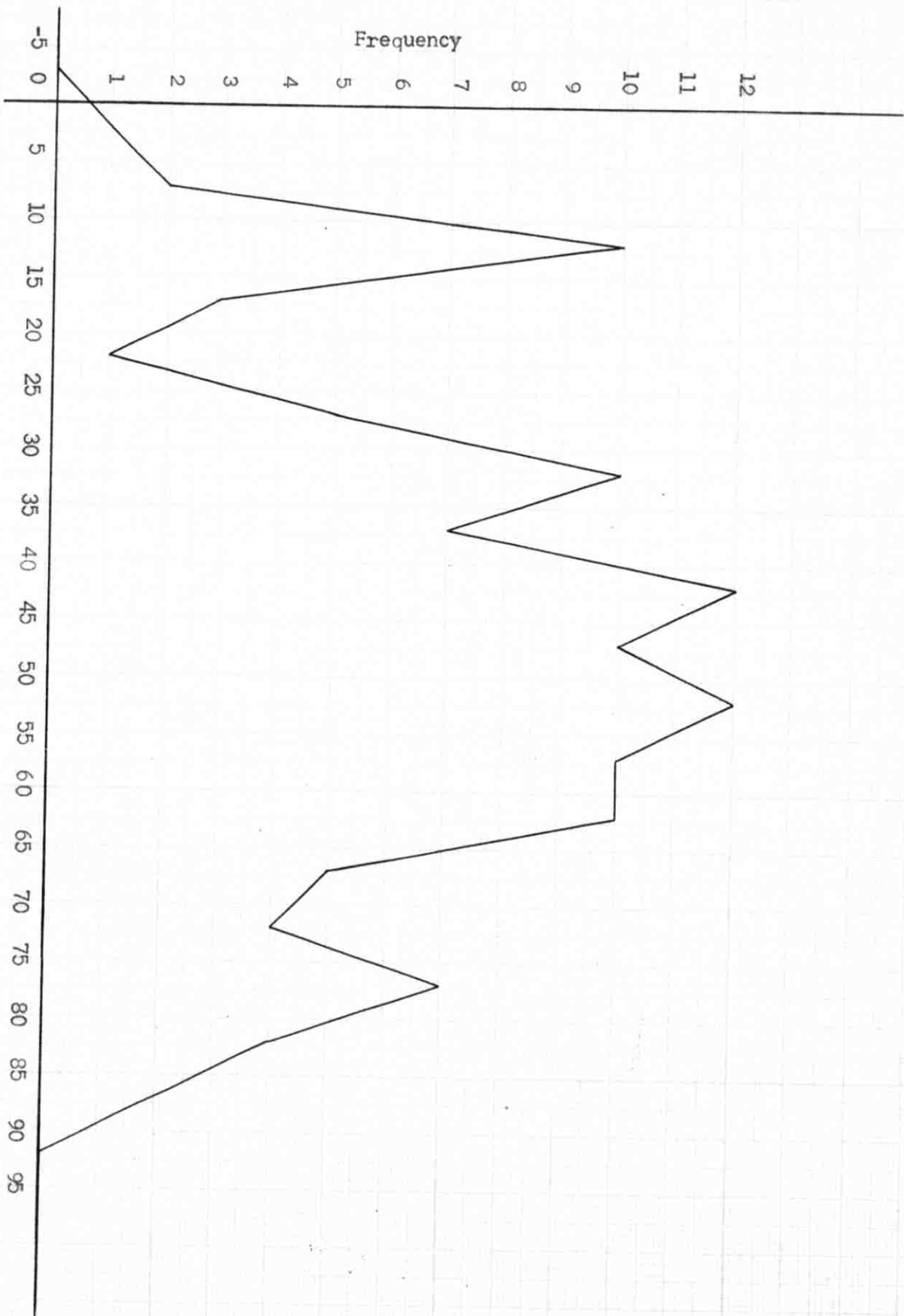
Mean = 51.58

Standard deviation = 20.7

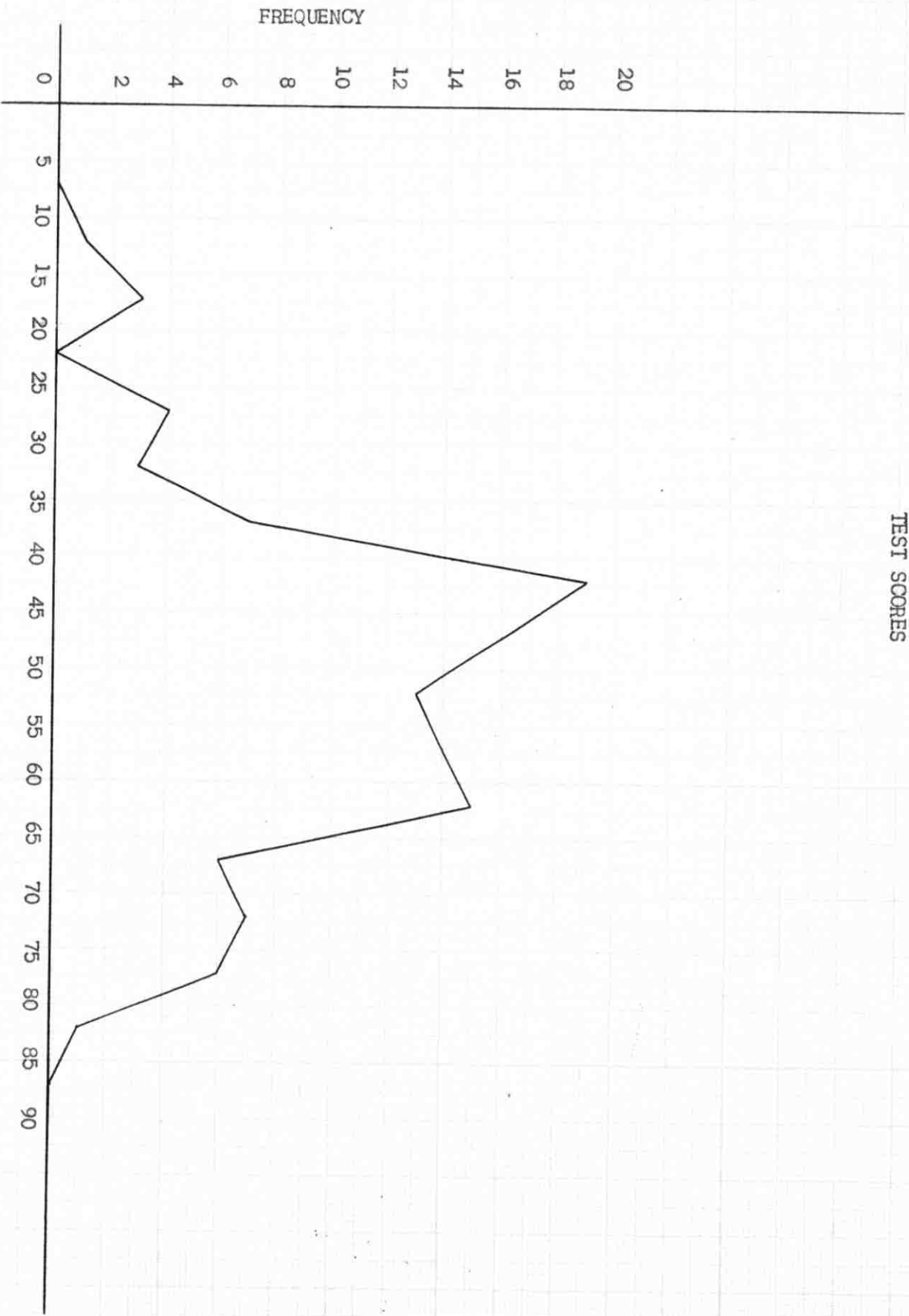
Standard deviation = 14.3



FREQUENCY POLYGON FOR THE TYPICAL INTERMEDIATE  
FINAL MATHEMATICS SCORES



FREQUENCY POLYGON FOR THE SUGGESTED OBJECTIVE  
TEST SCORES



## CHAPTER V

### CONCLUSIONS AND RECOMMENDATIONS

#### A. Results of the Two Tests:

Once again, the main purpose of this study is to investigate the possibility of constructing an improved instrument for evaluating achievement in mathematics at the end of the intermediate stage.

The statistical analyses of the results of the two tests - the prevailing and the suggested substitute - tempt one to conclude that both types are almost equally reliable and objective. But the suggested type of test (mainly objective) excels over the prevailing type in one of the most important characteristics of tests, namely, content validity. The degree of difficulty and level of discrimination of the items can be improved by further experimentation.

#### B. Recommendations:

There are certain objectives of teaching mathematics at the intermediate school that can best be tested by the objective type of examinations; whereas other objectives (such as producing long hand proof, expressing oneself clearly, etc.) do not lend

themselves be examined by such type of tests. It, thus, seems that the two types of tests are complementary rather than opposing each other. The Intermediate Final Mathematics may better meet its objective if it consists of two papers (instead of one): one of the essay type (similar to the prevailing paper) and the other of the objective type (similar to the suggested test). By having such two papers, most, if not all, of the extent to which the aims of teaching mathematics at the intermediate level have been met, can be measured in the best available way.

C. Suggested Topics for Further Research:

In conclusion, the following topics for further research are suggested:

- 1) The suitability of the present intermediate schools mathematics in the Sudan.
- 2) Experimentation with objective tests on the elementary level.
- 3) The effectiveness of present teaching methods in mathematics; and the preparation of the mathematics teachers.
- 4) A comparative study of the intermediate school mathematics as taught in the Sudan as compared with that in other Arab countries as well foreign advanced countries.

5) The effect of the medium of instruction (Arabic) on the understanding of mathematics in the various parts of the Sudan.

..... سيدى ( سيدتي ) ناظر ( ناظرة ) مدرسة

تحية طيبة مباركة وبعد ،

لقد بعثت من قبل وزارة التربية والتعليم السودانية لنيل شهادة الماجستير ( في تدريس الرياضيات ) من الجامعة الاميركية في بيروت . وقبل انتسابي للجامعة كنت اعمل بشعبة الرياضيات بمعهد التربية ببخت الرضا لمدة ست سنوات ( ١٩٦٠ - ١٩٦٦ ) . وكما تعلمون ان بخت الرضا مسؤولة عن وضع الامتحانات النهائية للمرحلتين الاولى والوسطى ومن ثم لقد اكتسبت خبرة عن كُتب في وضع هذين الامتحانين في الرياضيات . ومن خبرتي شعرت انه لا بد من دراسة علمية ان كان هذان الامتحانان يخدمان فعلا الغرض الذي يقصد بهما ومدى الاعتماد عليهما في تقييم عمل التلاميذ والتلميذات .

الآن لقد سنحت لي الفرصة لأن اقدم على هذه الدراسة وستكون دراستي قاصرة على " الامتحان النهائي للمدارس الوسطى والدخول للمدارس الثانوية في الرياضيات " . وعليه اخترت عددا من فصول السنة الرابعة وسطى بالسودان لعام ١٩٦٧ / ١٩٦٨ ( بنين وبنات ، حكومية واهلية ) لتمثل تمثيلا صحيحا كل فصول السنة الرابعة . ويطيب لى أن أخبركم بأني اخترت تلاميذ ( تلميذات ) السنة الرابعة بمدركتكم . فكم أكون شاكرا ومقدرا لسو تعاونتم معي .

نبذة عن هدف هذه الدراسة

سيكون أساس هذه الدراسة اختبارين في الرياضيات لفرق السنة الرابعة وسطى لعام ١٩٦٧ / ١٩٦٨ . هذان الاختباران يتفقان في أنهما يمتحنان نفس مقرر المدرسة الوسطى في الرياضيات ، كما يتفقان في الزمن المحدد لكل منهما ( ساعتين ) ، الا أنهما يختلفان في الشكل : أحدهما شبيه ( أو يمكن القول بأنه نموذج ) للامتحان الحالي ، والآخر يمكن وصفه بأنه يختلف عن الامتحان الحالي من حيث الشكل .

بعد موافقتكم بالسماح لي بأختياري تلاميذ (تلميذات) السنة الرابعة

ليكونوا (ليكن) ضمن العدد المختار لهذه الدراسة - هل لي ان أطلب : -

اولا : افادتي بموافقتكم بالسماح لي باعطاء اختياري هذه الدراسة لتلاميذ (تلميذات) السنة الرابعة بمدركتكم ، والزمن المناسب لاختبار هذين الاختبارين مع اعتبار أنهما يشملان كل مقرر الرياضيات للمدرسة الوسطى (حتى نهاية مقرر السنة الرابعة) . كما أرجو معرفة عدد تلاميذ (تلميذات) السنة الرابعة بمدركتكم حتى أرسل لكم العدد المناسب من أوراق الأسئلة . أرجو أن يكون ذلك في أقرب وقت ممكن ان لعامل الزمن أثرا ومضاعفات لا يفوت عليكم .

ثانيا : تدريب التلاميذ (التلميذات) - قبل حوالي أسبوع من اعطاء الاختبارين - على النوع الثاني (الجديد) باعطائهم الاختبار التجريبي الذي اعدته ليدرب التلاميذ (التلميذات) على أخذ الاختبار الأصلي دون ان يكون غريبا عليهم (عليهن) . سأرسل لكم مع الاختبار التجريبي الارشادات وخطة التصحيح . والذي ارجوه هو أن يصحح معلم (معلمة) الرياضيات بالسنة الرابعة هذا الاختبار التجريبي وان يرشد (ترشد) التلاميذ (التلميذات) . أما النوع الآخر الذي يشبه الامتحان الحالي فلا داعي لتدريب التلاميذ (التلميذات) عليه ان أنه ليس بغريب عليهم (عليهن) .

ثالثا : أشعار التلاميذ (التلميذات) بأهمية هذين الاختبارين لا من ناحية دراستي انما من زاوية استفادتهم (استفادتهن) لاعدادهم (لاعدادهن) للامتحان النهائي . وكلي أمل ان يستفيدوا (يستفدن) من هذين الاختبارين .

رابعا : تنفيذ ارشادات الاختبارين حرفيا حتى لا تفقد الدراسة شيئا ربما يكون من أهم مقوماتها .

خامسا : اعطاء الاختبارين - كل على حدة - وفي نفس اليوم .

سادسا : ارسال اوراق اجوبة الاختبارين لي دون تصحيحهما بالبريد الجوي بعنواني اعلاه .

سابعا : أرجو تقييم معلم (معلمة) الرياضيات لمقدرة التلاميذ (التلميذات) العقلية على ان يكون هذا التقييم في شكل ترتيب - اقدر التلاميذ (التلميذات) عقليا يكون (تكون) الأول (الاولى) ومن يليه (تليها) قدرة عقلية يكون (تكون) الثاني (الثانية) وهكذا .

ثامنا : ارجو امدادى بأكبر عدد من اختبارات الرياضيات التى وضعها معلمو (معلمات) السنة الرابعة لهذا العام والاعوام السابقة .

ملاحظة هامة : بما أن هذا البحث لا يقصد به مدرسة معينة فلن يكن هنالك مقارنة او تقييم للمدارس التى ستشارك في هذه الدراسة - لا بصفة خاصة ولا عامة . كما أن مفردات هذه الدراسة من أسماء للتلاميذ والتلميذات ستكون موضع سرية وكذلك تقييم مقدرات التلاميذ والتلميذات العقلية ستكون موضع سرية أيضا . أما النتائج بصفة عامة من حيث أى الاختبارين يخدم الغرض المنشود أكثر من الآخر سنطلعكم وسنطلع المسؤولين عليها لملاحقة هذه الدراسة وهذا النوع من الدراسات .

لقد أثقلت عليكم في الطلب ولكن كلي ثقة في أنكم ستتعاونون معي في هذا العمل الذى يشكل ناحية هامة في التربية الا وهي تقييم عمل تلاميذنا وتلميذاتنا ، كما يهمني فسي المرتبة الثانية اذ انه جزء هام ومكمل لدراستي لتحضيرى للشهادة التى بعثت لنيلها .  
تكرموا بقبول سالف شكرى وتقديرى .

مخلصكم ،

محمد الحسن صبير

محمد الحسن صبير



سيدي (سيدتي) ناظر (ناظرة) مدرسة .....

تحية طيبة مباركة

أ - شكر وتقدير

اسمحوا لي أن أتقدم لكم بوافر الشكر والتقدير على تعاونكم الصادق معي في الدراسة التي أقوم بها لتقييم عمل تلاميذنا وتلميذاتنا في الرياضيات .

ب - محتويات هذه الرسالة

- ١ - اختبار على النمط الحالي للامتحان النهائي - ولتسهيل الإشارة إليه فلنسمه "الاختبار الأول".
- ٢ - اختبار تجريبي - "الاختبار الثاني".
- ٣ - اختبار يختلف شكلاً عن الامتحان النهائي - "الاختبار الثالث".
- ٤ - كراسات الاجابة للاختبار الأول (ورقة الرسم البياني مرفقة مع الورقة الاخيرة من كل كراسة اجابة)

ج - ملاحظتان هامتان

- ١ - تسمية الاختبارات: "الاختبار الأول"، "الاختبار الثاني"، "الاختبار الثالث" مكتوبة على ورقة واحدة منفصلة لتبين نوع المحتويات - وهذه التسمية غير مكتوبة على الاختبارات نفسها .
- ٢ - ارجو الالتزام حرفياً بطريقة سير الاختبارات والارشادات عامة :

د - ترتيب اعطاء الاختبارات

ارجو ان تُعطى الاختبارات الثلاث في خلال مدة اقصاها اسبوع ، وعلى النحو التالي :

اولاً : الاختبار الأول

ثانياً : الاختبار الثاني

ثالثاً : الاختبار الثالث

هـ - سير الاختبارات

الاختبار الأول

- ١ - هذا الاختبار على نمط الامتحان النهائي الحالي ، ويتكوّن من ثمانية اسئلة .
- ٢ - الزمن المحدد : ساعتان
- ٣ - الاجابة على كراسات الاجابة للاختبار الاول (ارجو تنبيه التلاميذ ( التلميذات ) لورقة الرسم البياني المرفقة عند آخر كراسة الاجابة )
- ٤ - اطلبوا من كل تلميذ ( تلميذة ) كتابة اسمه ( اسمها ) واسم مدرسته ( مدرستها ) قبل البدء في الامتحان .
- ٥ - قبل جمع الاوراق تأكدوا من ان كل تلميذ ( تلميذة ) كتب ( كتبت ) اسمه ( اسمها ) واسم مدرسته ( مدرستها ) .
- ٦ - تكرموا بالاحتفاظ باوراق الاسئلة
- ٧ - تكرموا بارسال اوراق الاجابة - دون تصحيحها - لي بالبريد الجوي المسجل .

الاختبار الثاني

- ١ - يتكوّن هذا الاختبار من عشرين سسؤالاً .
- ٢ - الغرض من هذا الاختبار هو تدريب التلاميذ ( التلميذات ) على اخذ الاختبار الثالث .
- ٣ - هذا الاختبار شبيه بالاختبار الثالث من حيث أنواع الاسئلة .
- ٤ - الارشادات التي ترافق هذا الاختبار هي نفس الارشادات التي ترافق الاختبار الثالث .
- ٥ - يقرأ الاستاذ ( الاساتذة ) المراقب ( المراقبة ) الارشادات مع التلاميذ ( التلميذات ) مع الشرح وليتكلم ( ولتتكم ) بالاجابة عن كل الاسئلة الخاصة بكيفية الاجابة وفهم الارشادات .
- ٦ - الزمن غير محدد .
- ٧ - الاجابة على نفس ورقة الامتحان .
- ٨ - فليسمح للتلاميذ ( للتلميذات ) بالاستفسار عن كيفية الاجابة خلال سير الامتحان .
- ٩ - درّب ( درّبي ) التلاميذ ( التلميذات ) على كيفية فتح اوراق الامتحان - خاصة ورقة " اختيار الاجابات الصحيحة - النوع الاول " - بطريقة يسهل معها العمل .

- ١٠ - ارجو التكرم بتصحيحي هذا الاختبار وارجاع الاوراق للتلاميذ ( للتلميذات ) ومناقشة  
الاطااء معهم ( معهن ) للوثوق من ان كل تلميذ ( تلميذة ) عرف ( عرفت ) كيفية الاجابة .
- ١١ - ارجو الاحتفاظ باوراق هذا الاختبار .

### الاختبار الثالث

- ١ - هذا الاختبار يختلف شكلا عن الامتحان النهائي ، ويتكون من ستين سؤالا .
- ٢ - المسافة بين كل تلميذ بين ( تلميذتين ) متجاورين ( متجاورتين ) - على الاقل - متر واحد .
- ٣ - تقرأ الارشادات مع التلاميذ ( التلميذات ) ويسمح لهم ( لهن ) بالاسئلة الخاصة  
بالارشادات فقط .
- ٤ - الزمن المحدد ( خلا ف زمن الارشادات ) ساعتان .
- ٥ - الاجابة على نفس ورقة الامتحان .
- ٦ - لا يسمح للتلاميذ ( للتلميذات ) باى اسئلة ( ولا حتى كيفية الاجابة ) اثناء سير الامتحان .
- ٧ - اطلبوا من كل تلميذ ( تلميذة ) كتابة اسمه ( اسمها ) واسم مدرسته ( مدرستها ) قبل البدء  
في الامتحان .
- ٨ - قبل جمع الاوراق تأكدوا من ان كل تلميذ ( تلميذة ) كتب ( كتبت ) اسمه ( اسمها ) واسم  
مدرسته ( مدرستها ) .
- ٩ - ذكروا التلاميذ ( التلميذات ) بكيفية فتح اوراق الامتحان بطريقة يسهل معها العمل .
- ١٠ - تكرروا بارسال اوراق اجابة هذا الاختبار - بـون تصحيحها - لي بالبريد الجوى المسجل .

### و - المعلومات التي طلبتها

- اود ان اذكرم بالتكريم بارسال الاشياء التي طلبتها منكم في خطابي الاول وعسى :
- ١ - تقييم معلم ( معلمة ) الرياضيات لمقدرة التلاميذ ( التلميذات ) العقلية ، على ان يكون هذا  
التقييم في شكل ترتيب : اقدر التلاميذ ( التلميذات ) عقليا يكون ( تكون ) الاول ( الاولى )  
ومن يليه ( تليها ) يكون ( تكون ) الثاني ( الثانية ) وهكذا .

٢ - اختبارات الرياضيات التي وضعها معلمو (معلمات) السنة الرابعة لهذا العام والأعوام السابقة .

ز - مرة أخرى

مرة أخرى أحصر ما ستتكرمون بإرساله لي :

- ١ - أراء الاجابة للاختبار الاول .
- ٢ - أراء الاجابة للاختبار الثالث .
- ٣ - تقييم مقدرة التلاميذ ( التلميذات ) العقلية .
- ٤ - اختبارات الرياضيات - وضع معلمي ( معلمات ) السنة الرابعة

• تكرموا بقبول سالف شكري وتقديري .

مخلصكم

محمد الحسن صبير

## اختبار في الرياضيات

الاسم :

المدرسة :

### الارشادات

- لا تبدأ في العمل قبل ان يطاب منك المراقب ذلك .
- اكتب اسمك واسم مدرستك في المكان المبين أعلاه .
- استعمل قلم رصاص فقط - لا تستعمل الحبر - في اجاباتك لهذا الاختبار

### انواع الاسئلة

يتكوّن هذا الاختبار من نوعين من الاسئلة ؛ ويتكون كل نوع من قسمين - القسم الاول والقسم الثاني . لكل سؤال في القسم الاول درجة واحدة ، ولكل سؤال في القسم الثاني درجتان .

### النوع الاول

- (١) بعد كل سؤال تجد أربع اجابات .
- (٢) اجابة واحدة فقط من هذه الاجابات صحيحة .
- (٣) على الورقة المرفقة والمكتوب على اعلاها « اختيار الاجابات الصحيحة - النوع الاول » ضع  $\times$  على الحرف الذي يشير للاجابة الصحيحة .
- (٤) اذا أردت أن تغيّر اجابة فامسح اجابتك الاولى .
- (٥) اجب على كل الاسئلة . لا تضع زمناً طويلاً على سؤال واحد - اتركه وحاول غيره .

### مثال على النوع الاول

$$[1] = 5 + 7$$

- (أ) ٢ (ب) ٥ (ج) ٧ (د) ١٢  
نبين الاجابة الصحيحة على صفحة « اختيار الاجابات الصحيحة - النوع الاول » هكذا :

|          |   |   |   |   |
|----------|---|---|---|---|
| $\times$ | ج | ب | أ | ١ |
|----------|---|---|---|---|

### النوع الثاني

- (١) لكل سؤال مكان خاص للأجابة .
  - (٢) اذا طلب منك الاجابة فقط فاكتبها مباشرة ان أمكنك ذلك عقلياً ، والا يمكنك ان تبين عملك على الصفحة المقابلة للسؤال .
  - (٣) اذا طلب منك ان تبين عملك فليكن ذلك واضحاً وفي المكان المخصص .
- لا تبدأ في العمل قبل ان يطلب منك المراقب ذلك .

## بداية الامتحان النوع الاول

على صفحة « اختيار الاجابات الصحيحة - النوع الأول » التي تجدها عند آخر اوراق هذا الامتحان ضع × على الحرف الذي يشير الى الاجابة الصحيحة لكل سؤال في النوع الأول بقسميه الأول والثاني .

### القسم الاول

لكل سؤال في هذا القسم درجة واحدة .

$$[1] = 1,5 \times 0,082$$

(أ) 0,0123 (ب) 0,123 (ج) 1,23 (د) 12,3

[2] ٤٠٪ من مبلغ ما ٢٠٠ جنيهاً ؛ ما هو المبلغ ؟

(أ) ٨٠ جنيهاً (ب) ٢٠٠ جنيهاً (ج) ٤٢٠ جنيهاً (د) ٥٠٠ جنيهاً

[3] ناتج طرح - ٩ س من - ١٧ س هو

(أ) - ٢٦ س (ب) - ٨ س (ج) ٨ س (د) ٢٦ س

[4] حول  $\frac{29}{350}$  الى كسر عشري ( قرب الجواب لمنزلتين عشريتين )

(أ) 0,08 (ب) 0,083 (ج) 0,82 (د) 0,83

[5] اختصر : ٢١ س ÷ (- ٣ س )

(أ) ٧ س (ب) - ٧ س (ج) ٧ - (د) ٧

$$[6] = \sqrt{0,000049}$$

(أ) 0,00007 (ب) 0,0007 (ج) 0,007 (د) 0,07

### القسم الثاني

لكل سؤال في هذا القسم درجتان .

[7] رتب هذه الكسور تنازلياً ( مبتدئاً بالأكبر )  $\frac{2}{3}, \frac{3}{4}, \frac{7}{8}, \frac{5}{6}$

(أ)  $\frac{7}{8}, \frac{5}{6}, \frac{2}{3}, \frac{3}{4}$  (ب)  $\frac{2}{3}, \frac{3}{4}, \frac{5}{6}, \frac{7}{8}$  (ج)  $\frac{2}{3}, \frac{3}{4}, \frac{7}{8}, \frac{5}{6}$  (د)  $\frac{7}{8}, \frac{2}{3}, \frac{5}{6}, \frac{3}{4}$

$$[8] = 2 \div (0,004)$$

(أ) 0,0004 (ب) 0,0008 (ج) 0,002 (د) 0,008

[9] مضلع عدد اضلاعه ن . مجموع زواياه الداخلية ( بالقوائم ) هو

(أ) ٤ - ن ٢ (ب) ٢ ( ن - ٤ ) (ج) ن - ٢ (د) ٤ ن - ٢

[10] اذا كان أ = ٤ ، ب = ٦ ، اوجد قيمة  $\frac{3}{ب} - \frac{4}{أ} + أ$

(أ) ٢٣ - (ب) ٩ (ج) ٢٥ (د) ٢٦

[١١] نسبة ٤ أقدام الى ٨ بوصات كنسبة - 76 -

(د) ١ : ٦

(ج) ٦ : ١

(ب) ٤ : ٨

(أ) ٨ : ٤

## النوع الثاني

- (١) بعد كل سؤال تجد مكاناً خاصاً للأجابة .  
(٢) اذا طلب منك الاجابة فقط فاكتبها مباشرة ان امكنتك ذلك عقلياً والا يمكنك أن تبين عملك على الصفحة المقابلة للسؤال .  
(٣) اذا طلب منك أن تبين عملك فليكن ذلك واضحاً وفي المكان المخصص .

### القسم الاول

الاجابة

لكل سؤال في هذا القسم درجة واحدة .

[١٢] بيعت عربة بمبلغ ٩٦٠ جنيهاً بربح ٢٠٪ . اوجد ثمن شراء العربة .

[١٣] ازل الاقواس وضم الحدود المتشابهة :  $3(2 + s) - 2(s + 1) + 5$

[١٤] زوايا مثلث  $s^\circ$  ،  $(20 - s)^\circ$  ،  $(2s)^\circ$  . ما قيمة  $s$  ؟

[١٥] ما هو نصف قطر دائرة مساحتها ١٥٤ سم مربع ؟  $(\frac{22}{7} = \pi)$

[١٦] مربع مساحته  $s$  سم مربع . ما هو محيطه ؟

### القسم الثاني

لكل سؤال في هذا القسم درجتان .

[١٧] احسب مساحة  $\Delta$  أ ب ج الذي فيه أ ب = ١٠٠ سم ،  $\angle ب = 90^\circ$  ،  $\angle ج = 22^\circ$  .

[١٨] ما هو السعر الذي وضع به مبلغ ٥٠٠ جنيه فربح ٧٥ جنيهاً في ٦ سنوات بالربح البسيط؟

$$\sqrt[3]{\frac{897,8}{3,14}}$$

[١٩] استعمل اللوغاريتمات لايجاد قيمة

[٢٠] وضّح كل العمل الضروري

ينجز أحمد عملاً في ٢٠ يوماً وينجز ابراهيم نفس العمل في ٣٠ يوماً . فاذا اشتغل احمد و ابراهيم معاً ، ففي كم يوم  
ينجزان العمل ؟

## اختيار الاجابات الصحيحة - النوع الاول

|   |   |   |   |    |
|---|---|---|---|----|
| د | ج | ب | أ | ٣١ |
| د | ج | ب | أ | ٣٢ |
| د | ج | ب | أ | ٣٣ |
| د | ج | ب | أ | ٣٤ |
| د | ج | ب | أ | ٣٥ |

|   |   |   |   |    |
|---|---|---|---|----|
| د | ج | ب | أ | ٢١ |
| د | ج | ب | أ | ٢٢ |
| د | ج | ب | أ | ٢٣ |
| د | ج | ب | أ | ٢٤ |
| د | ج | ب | أ | ٢٥ |
| د | ج | ب | أ | ٢٦ |
| د | ج | ب | أ | ٢٧ |
| د | ج | ب | أ | ٢٨ |
| د | ج | ب | أ | ٢٩ |
| د | ج | ب | أ | ٣٠ |

|   |   |   |   |    |
|---|---|---|---|----|
| د | ج | ب | أ | ١١ |
| د | ج | ب | أ | ١٢ |
| د | ج | ب | أ | ١٣ |
| د | ج | ب | أ | ١٤ |
| د | ج | ب | أ | ١٥ |
| د | ج | ب | أ | ١٦ |
| د | ج | ب | أ | ١٧ |
| د | ج | ب | أ | ١٨ |
| د | ج | ب | أ | ١٩ |
| د | ج | ب | أ | ٢٠ |

|   |   |   |   |    |
|---|---|---|---|----|
| د | ج | ب | أ | ١  |
| د | ج | ب | أ | ٢  |
| د | ج | ب | أ | ٣  |
| د | ج | ب | أ | ٤  |
| د | ج | ب | أ | ٥  |
| د | ج | ب | أ | ٦  |
| د | ج | ب | أ | ٧  |
| د | ج | ب | أ | ٨  |
| د | ج | ب | أ | ٩  |
| د | ج | ب | أ | ١٠ |



## اختبار في الرياضيات

الزمن المحدد : ساعتان

اجب على كل الاسئلة

[1] (أ) اختصر :  $\frac{\frac{1}{3} - \frac{4}{5}}{\frac{8}{15} - 1} \times \frac{2}{3} - 1 \frac{5}{16} \div \frac{7}{8}$

(ب) اختصر :  $\frac{س 2}{3} - \frac{س 5}{12} + \frac{س 7}{8}$

(ج) اذا كانت الزاوية الداخلية لمضلع منتظم تساوي  $160^\circ$  ، احسب عدد اضلاع المضلع .

(د) في المثلث أ ب ج :  $\angle ب > 90^\circ$  ، أ ب =  $\frac{1}{2}$  ب ج . احسب ظا  $\angle ج$  بدون استعمال الجداول .

(هـ) اوجد قيمة س اذا كان  $\frac{5}{2} = \frac{25}{س 4}$

[2] (أ) اوجد ثلاثة اعداد متتالية بحيث ضعف الاكبر مضافاً اليه ثلاثة امثال الاصغر يساوي 34 .

(ب) حل المعادلة  $\frac{1}{4} (س - 2) - \frac{1}{6} (س - 5) + 1 = \frac{س 3}{20}$  . صفر .

[3] (أ) 'وزع مبلغ من المال بين ثلاثة اولاد بنسبة 2 : 3 : 5 وكان نصيب الثالث 6,5 جنيهاً . اوجد نصيب الاول ونصيب الثاني .

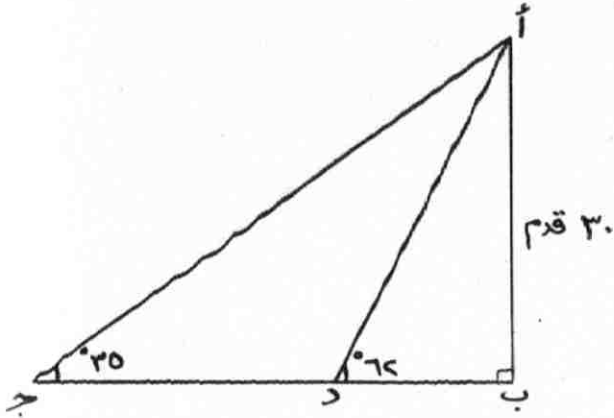
(ب) مقياس رسم على خريطة ما 3 سم  $\equiv$  6 كلم . اوجد مساحة قطعة ارض مربعة الشكل على الخريطة اذا كان مساحتها على الارض 36 كلم مربع .

[4] 'وضع مبلغ في بنك بسعر 5% ربح مركب ، وكان مقدار ربح المبلغ في مدة سنين 205 جنيهاً . اوجد المبلغ الذي وضع في البنك في بداية السنة الاولى .

[5] ارسم الرباعي أ ب ج د الذي فيه أ ب = 8 سم ،  $\angle أ = 70^\circ$  ،  $\angle ب = 80^\circ$  ، أ ب يوازي ج د ، والمسافة العمودية بين أ ب ، ج د تساوي 6 سم .

(أ) قس طول ج د .

(ب) احسب مساحة الرباعي أ ب ج د ( اعط الجواب مقرباً لمنزلة عشرية واحدة ) .



[٦] في هذا الشكل ( الى اليسار ) :

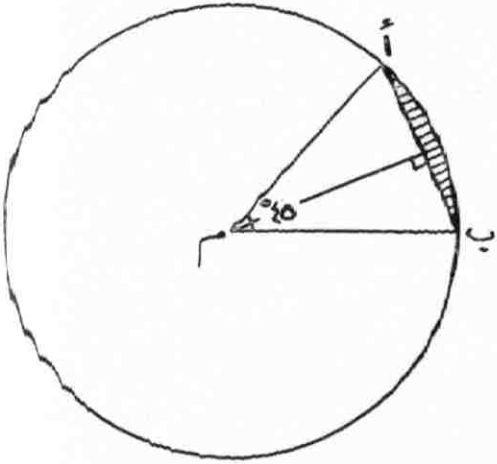
$$أ ب = 30 \text{ قدم} ، ب = 62^\circ ، أ د ب = 62^\circ ، أ ج د = 35^\circ$$

(١) اوجد باستعمال جداول الظلال :

( أ ) طول ب د

( ب ) طول ب ج

(٢) احسب مساحة المثلث أ د ج ( اعط الجواب مقرباً الى منزلتين عشريتين ) .



[٧] في الشكل ( الى اليسار ) :

$$م \text{ مركز الدائرة} ، أ م ب = 45^\circ ، \text{مساحة القطاع } أ م ب = \frac{11}{8} \times 66 \text{ سم مربع} ، \text{خذ } \frac{22}{7} = \pi$$

( أ ) احسب طول نصف قطر الدائرة .

( ب ) احسب مساحة الجزء المظلل ،

اذا كان طول الوتر أ ب = 10 سم .

[ ارشاد : اوجد طول العمود من م الى أ ب ]

[٨] س ، ص مقداران متغيران يربطهما القانون :

$$ص = \sqrt{s} \quad ( \text{س اي عدد ، ص الجذر التربيعي لذلك العدد} )$$

( أ ) باستعمال جداول اللوغاريتمات اكمل الجدول ادناه الذي يربط س ، ص ( قرب لنتزة عشرية واحدة )

|   |   |   |   |   |   |   |   |   |   |    |    |    |    |
|---|---|---|---|---|---|---|---|---|---|----|----|----|----|
| س | ١ | ٢ | ٣ | ٤ | ٥ | ٦ | ٧ | ٨ | ٩ | ١١ | ١٣ | ١٤ | ١٦ |
| ص | ١ | ٢ | ٣ | ٤ | ٥ | ٦ | ٧ | ٨ | ٩ | ١١ | ١٣ | ١٤ | ١٦ |

( ب ) استعمل المحور الاقضي لـ س ؛ 1 سم  $\equiv$  1

استعمل المحور الرأسي لـ ص ؛ 2 سم  $\equiv$  1

( ج ) ارسم رسماً بيانياً لقيم س ، ص

( د ) (١) من رسملك اوجد الجذر التربيعي لـ 7 ، 15 .

(٢) من رسملك اوجد مربع 2.7 ، 3.6 .

SUGGESTED TEST AND ITS SCORING PLAN

اختبار في الرياضيات

الاسم :

المدرسة :

## الارشادات

- لا تبدأ في العمل قبل ان يطلب منك المراقب ذلك .
- اكتب اسمك واسم مدرستك في المكان المبين أعلاه .
- استعمل قلم رصاص فقط - لا تستعمل الحبر - في اجاباتك لهذا الاختبار

### انواع الاسئلة

يتكوّن هذا الاختبار من نوعين من الاسئلة ؛ ويتكون كل نوع من قسمين - القسم الاول والقسم الثاني . لكل سؤال في القسم الاول درجة واحدة ، ولكل سؤال في القسم الثاني درجتان .

### النوع الاول

- (١) بعد كل سؤال تجد أربع اجابات .
- (٢) اجابة واحدة فقط من هذه الاجابات صحيحة .
- (٣) على الورقة المرفقة والمكتوب على اعلاها « اختيار الاجابات الصحيحة - النوع الاول » ضع  $\times$  على الحرف الذي يشير للاجابة الصحيحة .
- (٤) اذا أردت أن تغيّر اجابة فامسح اجابتك الاولى .
- (٥) اجب على كل الاسئلة . لا تضع زمناً طويلاً على سؤال واحد - اتركه وحاول غيره .

### مثال على النوع الاول

$$[١] = ٥ + ٧$$

(أ) ٢ (ب) ٥ (ج) ٧ (د) ١٢

نبين الاجابة الصحيحة على صفحة « اختيار الاجابات الصحيحة - النوع الاول » هكذا :

|   |   |   |   |
|---|---|---|---|
| ا | ب | ج | د |
|---|---|---|---|

### النوع الثاني

- (١) لكل سؤال مكان خاص للأجابة .
  - (٢) اذا طلب منك الاجابة فقط فاكتبها مباشرة ان امكنتك ذلك عقلياً ، والا يمكنك ان تبين عملك على الصفحة المقابلة للسؤال .
  - (٣) اذا طلب منك ان تبين عملك فليكن ذلك واضحاً وفي المكان المخصص .
- لا تبدأ في العمل قبل ان يطلب منك المراقب ذلك .

## بداية الامتحان

### النوع الاول

على صفحة « اختيار الاجابات الصحيحة - التمرع الاول » ، التي تجدهما عند آخر اوراق هذا الامتحان ،  
ضع × على الحرف الذي يشير الى الاجابة الصحيحة لكل سؤال في النوع الاول بقسميه الاول والثاني .

القسم الاول One point for each item  
(Items 1-22)

لكل سؤال في هذا القسم درجة واحدة .

[١] أي الاعداد الآتية عامل من عوامل ٣٤ ؟

- (أ) ٢ (ب) ٣ (ج) ٤ (د) ٧

[٢]  $0.0025 \div 0 = 0$

- (أ) ٠,٠٠٠٥ (ب) ٠,٠٠٠٥ (ج) ٠,٠٠٥ (د) ٠,٥

[٣] حاصل ضرب  $259 \times 897$  يزيد على حاصل ضرب  $258 \times 897$  بـ

- (أ) ١ (ب) ٢٥٨ (ج) ٢٥٩ (د) ٨٩٧

[٤] اختصر :  $5 \frac{3}{4} - 1 \frac{1}{8} \div \frac{3}{4}$

- (أ)  $4 \frac{4}{9}$  (ب)  $4 \frac{21}{32}$  (ج)  $5 \frac{1}{12}$  (د)  $5 \frac{5}{8}$

[٥] اذا قسم عدد على ١٥ فإن أكبر باقٍ يمكن أن يكون

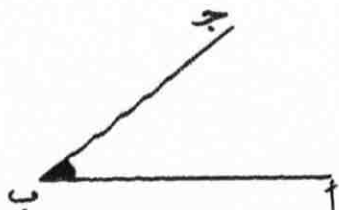
- (أ) ٥ (ب) ١٤ (ج) ١٥ (د) ١٦

[٦] أي هذه الاعداد أولي ؟

- (أ) ٢ (ب) ٤٦ (ج) ٥١ (د) ١١١

[٧] الزاوية المظللة ( في الشكل الى اليسار )

لا يمكن تسميتها بالآتي :



- (أ)  $\angle A > \angle B$  (ب)  $\angle B > \angle A$  (ج)  $\angle B > \angle B$  (د)  $\angle B > \angle A$

- ٢ -

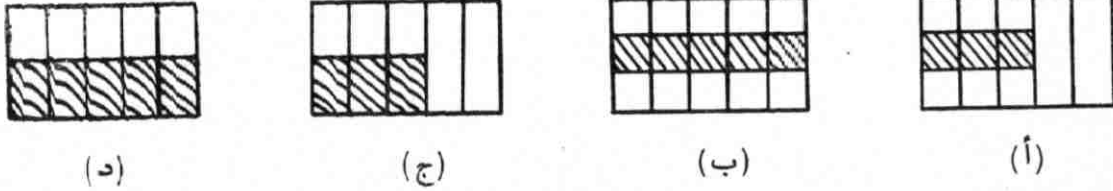
[٨] اين استعملت علامة = استعمالاً صحيحاً ؟

- (أ)  $s - s = s - s$  (ب)  $s \div s = s \div s$   
 (ج)  $s \ s = s \ s$  (د)  $s + s = s - s$

[٩] الجذر التربيعي لـ  $\frac{s}{4}$  هو

- (أ)  $\frac{s}{4}$  (ب)  $\frac{s}{2}$  (ج)  $\frac{s}{16}$  (د)  $\frac{s}{2}$

[١٠] في أي شكل يدل الجزء المظلل على  $\frac{1}{2}$  الـ  $\frac{3}{5}$  ؟



[١١] مقياس رسم خريطة ١ : ٢٠٠ ٠٠٠ . البعد بين مدينتين على هذه الخريطة ٢ سم . البعد الحقيقي بين هاتين المدينتين هو :

- (أ) ١ كيلومتر (ب) ٤ كيلومتر (ج) ١٠٠ ٠٠٠ كيلومتر (د) ٢٠٠ ٠٠٠ كيلومتر

[١٢] اذا استخدمنا مقياس رسم لرسم شكل ما ، فإن الأبعاد على الرسم

- (أ) تكون دائماً اصغر من الأبعاد الحقيقية . (ب) تكون دائماً اكبر من الأبعاد الحقيقية .  
 (ج) تكون دائماً مساوية للأبعاد الحقيقية . (د) يمكن ان تكون اكبر من الأبعاد الحقيقية .

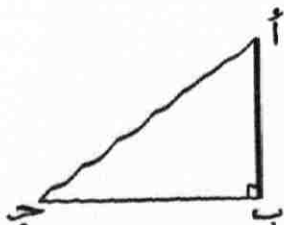
[١٣] لو  $s = ٠,٠٤٩٢$

= س

- (أ) ٠,٣١٠٥ (ب) ١,١٢٠ (ج) ٣,١٠٥ (د) ٦,٩٢٠

[١٤] في هذا الشكل ( الى اليسار ) :

ظا > ب أ ج =



- (أ)  $\frac{AB}{BC}$  (ب)  $\frac{BC}{AB}$  (ج)  $\frac{AB}{AC}$  (د)  $\frac{AC}{AB}$

[١٥] مساحة شبه المنحرف تساوي

- (أ) (متوسط الضلعين غير المتوازيين)  $\times$  الارتفاع  
(ب) (متوسط الضلعين المتوازيين)  $\times$  الارتفاع  
(ج) (مجموع الضلعين المتوازيين)  $\times$  الارتفاع  
(د) (مجموع الضلعين غير المتوازيين)  $\times$  الارتفاع

[١٦] سار احمد بسرعة ٥ كيلومتر في الساعة ؛ وبعد نصف ساعة اراد ابراهيم ان يلحق به فسار في اتجاهه بسرعة ٥ كيلومتر في الساعة .

- (أ) ابراهيم سيلحق بأحمد بعد ساعة .  
(ب) لن يلحق ابراهيم بأحمد لان المسافة بينهما ستظل ثابتة .  
(ج) لن يلحق ابراهيم بأحمد لان المسافة بينهما تزيد بمرور الزمن .  
(د) ابراهيم سيلحق بأحمد بعد زمن يختلف عن ساعة .

$$[١٧] = {}^3(٤٧) \div {}^6(٤٧)$$

- (أ)  $\frac{1}{2}$   
(ب) ٢  
(ج)  ${}^2(٤٧)$   
(د)  ${}^3(٤٧)$

$$[١٨] = ٥ - (٥ - ١٠) + ١٠ = ٥$$

- (أ) ٥ -  
(ب) صفر  
(ج) ٥  
(د) ١٠

[١٩] ما هو متوسط س ٣ ، س ٢ ، س ؟

- (أ) س  
(ب)  $\frac{3}{2}$   
(ج) ٢  
(د) ٣

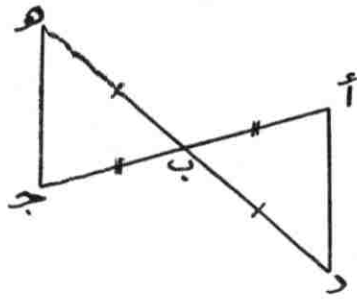
[٢٠] ينجز س رجلا عملا في ص يوماً ، ففي كم يوم ينجزع رجلا نفس العمل ؟  
( ملاحظة : كل الرجال يعملون بنفس القدر )

- (أ) س ص ع يوماً  
(ب)  $\frac{س ص}{ع}$  يوماً  
(ج)  $\frac{س ع}{ص}$  يوماً  
(د)  $\frac{ص ع}{س}$  يوماً

[٢١] ينطبق مثلثان اذا تساوى في احدهما

- (أ) زاويتان وضع لنظائرها في المثلث الآخر .  
(ب) ضلعان وزاوية لنظائرها في المثلث الآخر .  
(ج) ثلاث زوايا لنظائرها في المثلث الآخر .  
(د) وتر وزاوية قائمة لنظائرها في المثلث الآخر .

[٢٢] في الشكل ( الى اليسار ) :



أ ج ، د ه ينصفان بعضهما في النقطة ب.

المثلثان أ د ب ، ج ه ب

( أ ) متطابقان ( ضلعان والزواوية المحصورة بينهما )

( ب ) متطابقان ( ثلاثة اضلاع )

( ج ) متطابقان ( زاويتان وضلع )

( د ) غير متطابقين

القسم الثاني Two points for each item  
(Items 23-35)

لكل سؤال في هذا القسم درجتان .

[٢٣] هل المثلثان أ ب ج ، س ص ع

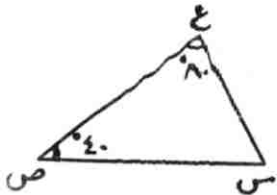
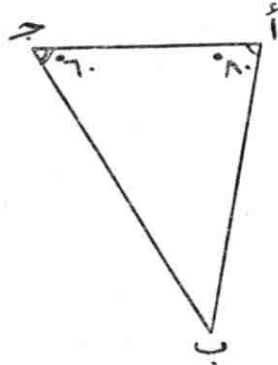
متشابهان ؟ ولماذا ؟

( أ ) لا ، لانها غير متطابقين .

( ب ) لا ، لان الزوايا المتناظرة لا تساوي بعضها .

( ج ) نعم ، لانها متطابقين .

( د ) نعم ، لان الزوايا المتناظرة متساوية .



[٢٤] ما مساحة معين ضلعه ٦ سم ، وقطراه ٨ سم و ١٠ سم ؟

( أ ) ٣٦ سم مربع ( ب ) ٤٠ سم مربع ( ج ) ٥٤ سم مربع ( د ) ٨٠ سم مربع

[٢٥] اذا كان ثمن شراء سلعة س جنياً و ثمن بيعها ص جنياً ، فان نسبة الربح في المائة هي

( أ )  $\frac{ص - س}{ص} \times ١٠٠\%$  ( ب )  $\frac{س - ص}{س} \times ١٠٠\%$  ( ج )  $\frac{ص - س}{ص} \times ١٠٠\%$  ( د )  $\frac{ص - س}{س} \times ١٠٠\%$

[٢٦] محيط مربع ضلعه ١٢ متراً مساو لمحيط مستطيل عرضه ٩ امتار . كم هو طول المستطيل ؟

( أ )  $\frac{١}{٣}$  متراً ( ب ) ١٥ متراً ( ج ) ١٦ متراً ( د ) ٣٠ متراً

[٢٧] الخط المستقيم أب يمر بمركز كل من الدوائر الأربع.

ما هي العلاقة بين محيط الدائرة الكبرى

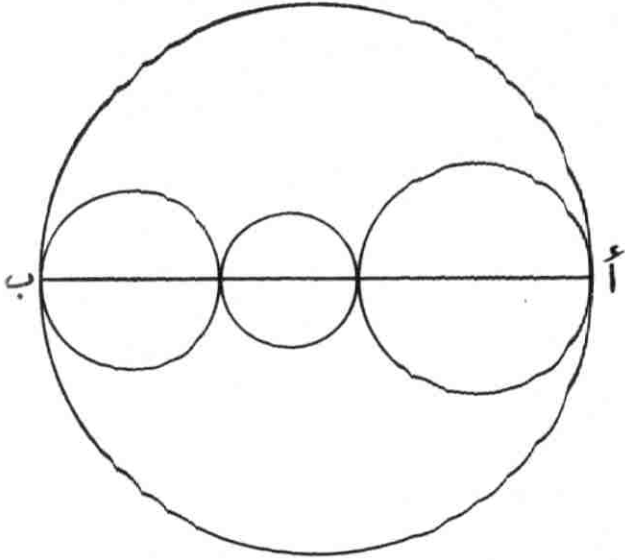
ومجموع محيط الدوائر الثلاث الأخرى ؟

( أ ) مجموع محيط الثلاث دوائر أكبر من محيط الدائرة الكبرى.

( ب ) مجموع محيط الثلاث دوائر أصغر من محيط الدائرة الكبرى.

( ج ) محيط الدائرة الكبرى مساوٍ لمجموع محيط الثلاث دوائر الأخرى.

( د ) لا يمكننا معرفتها لأننا نجهل أنصاف أقطار هذه الدوائر.



[٢٨] اسطوانة مفتوحة الطرفين ، قطرها الخارجي ١٤ سم وطولها ١٠ سم ؛  $\frac{22}{7} = \pi$ .

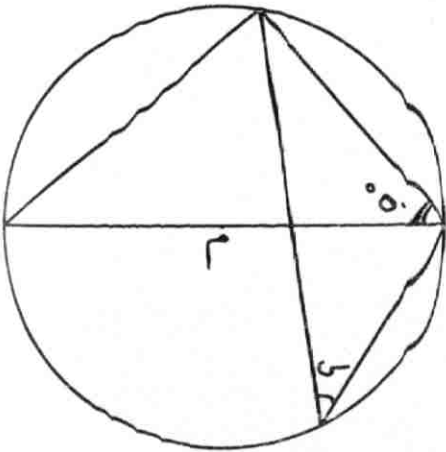
مساحة السطح الخارجي لهذه الاسطوانة يساوي

- ( أ ) ٢٢٠ سم مربع ( ب ) ٤٤٠ سم مربع ( ج ) ٨٨٠ سم مربع ( د ) ١٥٤٠ سم مربع

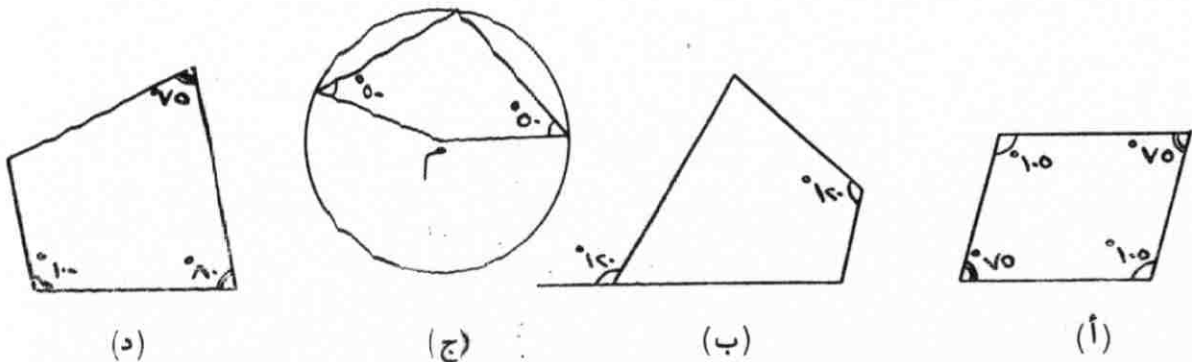
[٢٩] في الشكل ( الى اليسار ) : م مركز الدائرة .

$\angle$  س =

- ( أ ) ٢٠° ( ب ) ٤٠° ( ج ) ٥٠° ( د ) كل الاجابات السابقة خطأ



[٣٠] أي الاشكال الرباعية الآتية دائري ؟ ( م مركز الدائرة )



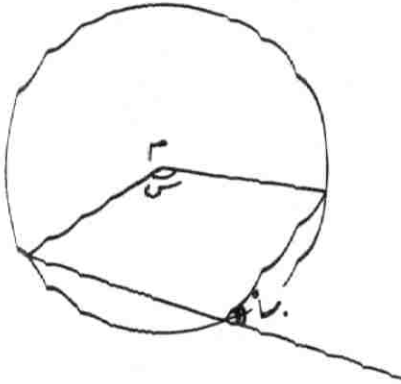


- ٦ -

[٣١] في الشكل ( الى اليسار ) : م مركز الدائرة

$$= س >$$

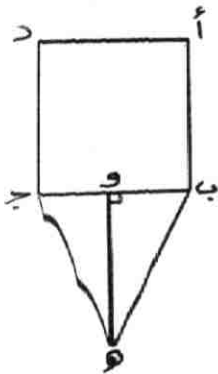
(أ) ٧٠° (ب) ١١٠° (ج) ١٤٠° (د) ٢٢٠°



[٣٢] في الشكل ( الى اليسار ) : مساحة المربع أ ب ج د = ٢ × مساحة المثلث هـ ب ج -

ما قيمة هـ و : ب ج ؟

(أ) ٢ : ١ (ب) ١ : ٢ (ج) ١ : ١ (د) ٤ : ١



[٣٣] مكعب من الخشب حجمه ٣,٥٤٧ متراً مكعباً . ضلع هذا المكعب يساوي

(أ) ١,١٨٢ متراً (ب) ١,٥٢٥ متراً (ج) ١,٥٣٢ متراً (د) ١,٨٨٤ متراً .

[٣٤] قطعة قماش مستطيلة الشكل ، نقص طولها ٥% كما نقص عرضها ٥% بعد الغسيل .

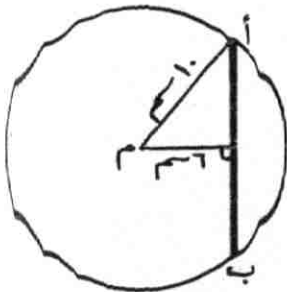
النسبة المئوية للنقصان في المساحة تساوي

(أ) ٥% (ب) ٩,٧٥% (ج) ١٠% (د) ٢٥%

[٣٥] في الشكل ( الى اليسار ) : م مركز الدائرة .

طول الوتر أ ب يساوي

(أ) ٨ سم (ب) ١٢ سم (ج) ١٦ سم (د) ٢٠ سم



## النوع الثاني

(١) بعد كل سؤال تجد مكاناً خاصاً للاجابة .

(٢) اذا طلب منك الاجابة فقط فاكتبها مباشرة ان امكنك ذلك عقلياً والا يمكنك ان تبين عملك على الصفحة المقابلة للسؤال .

(٣) اذا طلب منك ان تبين عملك فليكن ذلك واضحاً وفي المكان المخصص .

القسم الاول One point for each item  
(Items 36-45)

الاجابة

[٣٦] انظر الى هذه الكسور :  $0,1789$  ،  $0,182$  ،  $0,0998$  ،  $0,1812$  ،  $0,1809$  ا.د  
ما هو أكبرها ؟

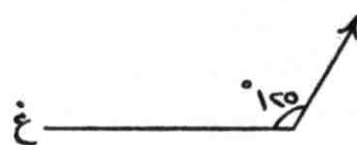
١٨٤

الأربعاء

[٣٧] اول يناير ١٩٦٨ يوم الاثنين. اي يوم من ايام الاسبوع يكون اول يناير ١٩٦٩ ؟

ش ٣٥°

اكتب الاتجاه المشار اليه بالسهم



%٣

[٣٩] ما السعر الذي وُضع به مبلغ ٤٠٠ جنيه لمدة ٥ سنوات فربح ٦٠ جنيهاً بالربح البسيط ؟

١٦٠ سم مكعب

[٤٠] متوازي مستطيلات من الصلب طوله ١٠ سم وقاعدته مربع ضلعه ٤ سم. ما حجمه ؟

٤٤,٣

[٤١]  $0,59049 = \sqrt{243}$  ما قيمة  $\sqrt{0,59049}$  ؟

٣٠٠

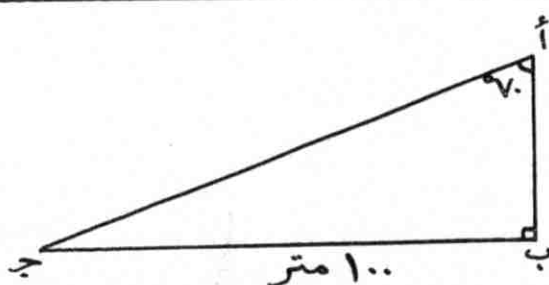
[٤٢]  $(51,5) - (48,5)$

$\frac{180}{\pi} = \pi$  ص

[٤٣] اجعل س موضوع القانون :  $\frac{\pi}{180} = \frac{\pi}{180} \times \text{س}$

٣٦,٤ متر

احسب طول أ ب



٩

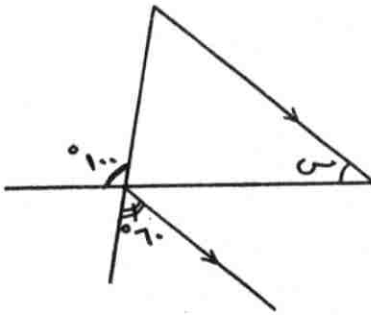
[٤٥] مضلع منتظم إحدى زواياه الخارجية  $40^\circ$ . كم عدد اضلاعه ؟

$\frac{\sqrt{3}}{2}$  (أو  $\frac{\sqrt{3}}{4}$ ) ص

القسم الثاني  
Two points for each item (Items 46-60)  
لكل سؤال في هذا القسم درجتان .

[٤٦] قطر مربع ص سم . ضلع هذا المربع يساوي

-- ٨ --

|  |   |
|--|---|
| <p>1 الاجابة 1<br/> <math display="block">\frac{2-5-3}{0} = \frac{2-5-3}{0}</math></p> | <p>[٤٧] عتبر جبرياً : من ثلاثة امثال عدد ما اطرح ٢ واقسم الناتج على ٥ لتحصل على نفس النتيجة كما لو طرحت ضعف العدد من ٢٣ . ( افرض العدد س )</p>                                  |
| <p>٦</p>   | <p>[٤٨] اختصر : <math>\frac{4}{21} \div \frac{8^2 \sqrt{3}}{7^3 \sqrt{2}}</math></p>  |
| <p>٤٠</p>  | <p>[٤٩] في هذا الشكل الاسهم تدل ان الخطوط متوازية.<br/> <math>\angle 1 = \angle 2</math></p>  |

في الاسئلة ٥٠ ، ٥١ ، ٥٢ بيّن كل العمل الضروري تحت السؤال .

[٥٠] حل المعادلة :  $3 - 5 = 3 - (2 - 3)$

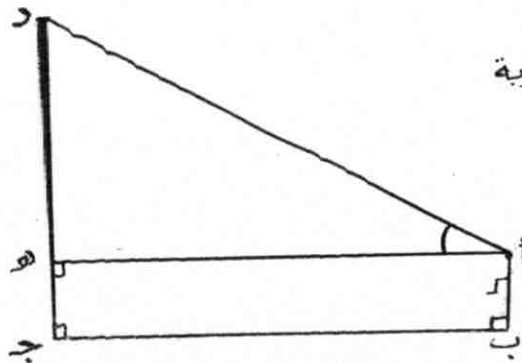
$$\frac{1}{2} \quad 6 + 3 - 5 = 3 - 3$$

$$\frac{1}{2} \quad 3 - 6 + 5 = 3 + 3 - 3$$

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

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

[٥١] ارسم وعيّن زاوية ارتفاع النقطة د بالنسبة للشخص أ ب



دأه هي الزاوية المطلوبة

1 for drawing the angl

1 for specifying the a

[٥٢] عيّن مركز الدائرة التي تمر بالنقاط أ ، ب ، ج أدناه

م هي مركز الدائرة

ج ×

(أ) ×

ب ×

[٥٣] املأ المكانين الشاغرين في الجدول ادناه . س ، ص يربطهما القانون : - 89 -

$$ص = \frac{1}{4}س + ٣$$

|    |    |   |     |   |
|----|----|---|-----|---|
| ٦  | ٤  | ٢ | صفر | س |
| ٢١ | ١١ | ٥ | ٣   | ص |
| 1  |    |   | 1   |   |

[٥٤] اكتب اسم كل محور في المكان الشاغر

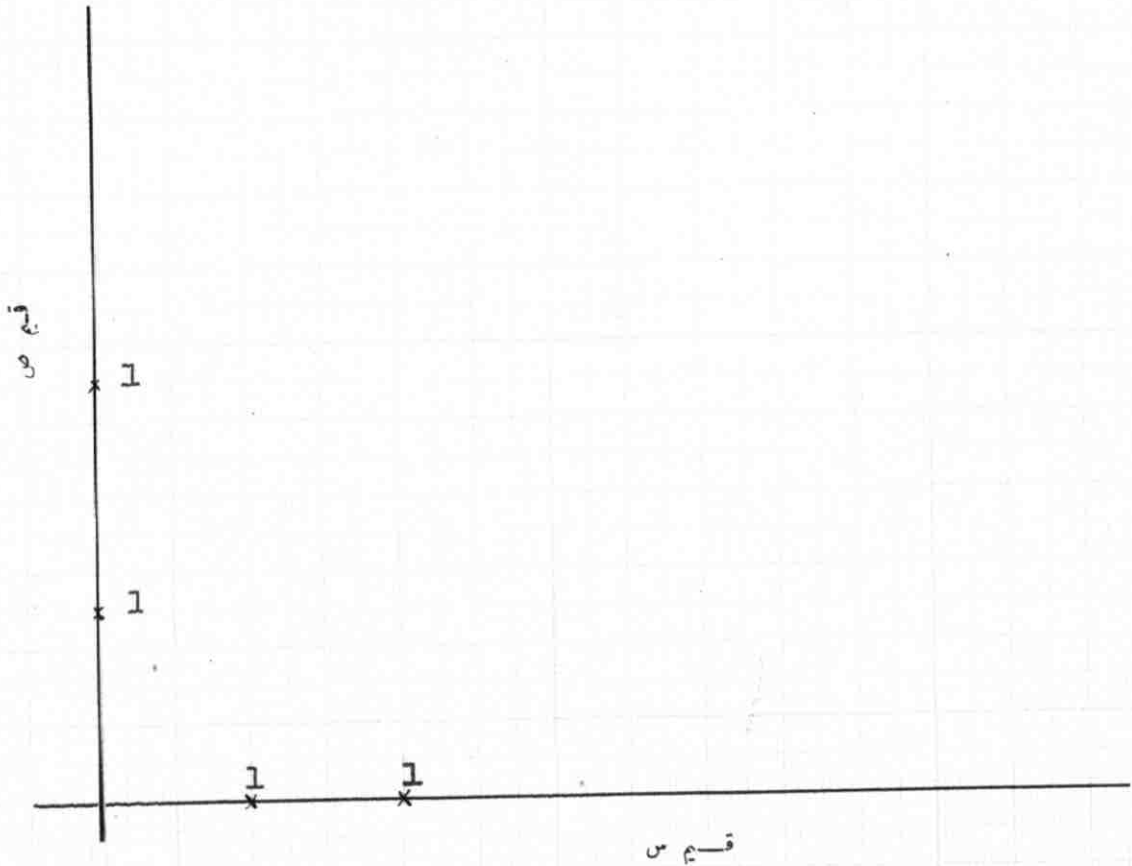
المحور  
العمودي

1

المحور  
الأفقي

1

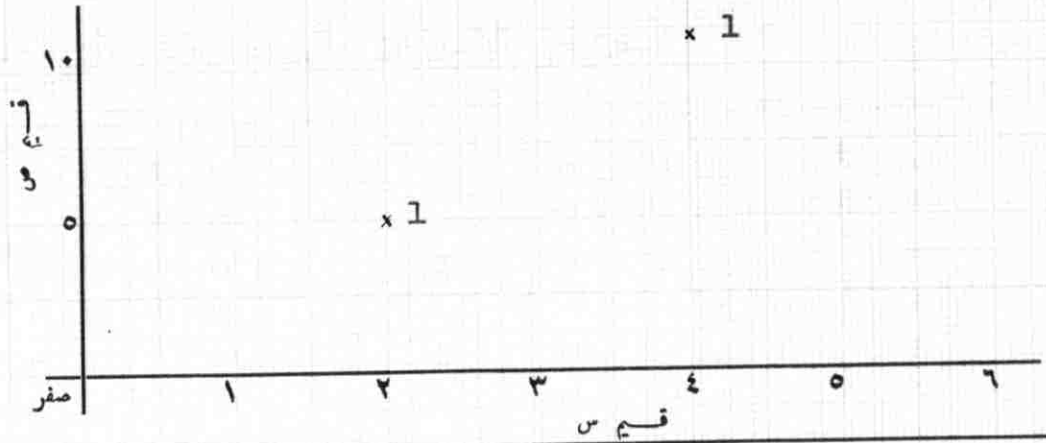
اجب على السؤالين ٥٥ و ٥٦ على المحورين التاليين



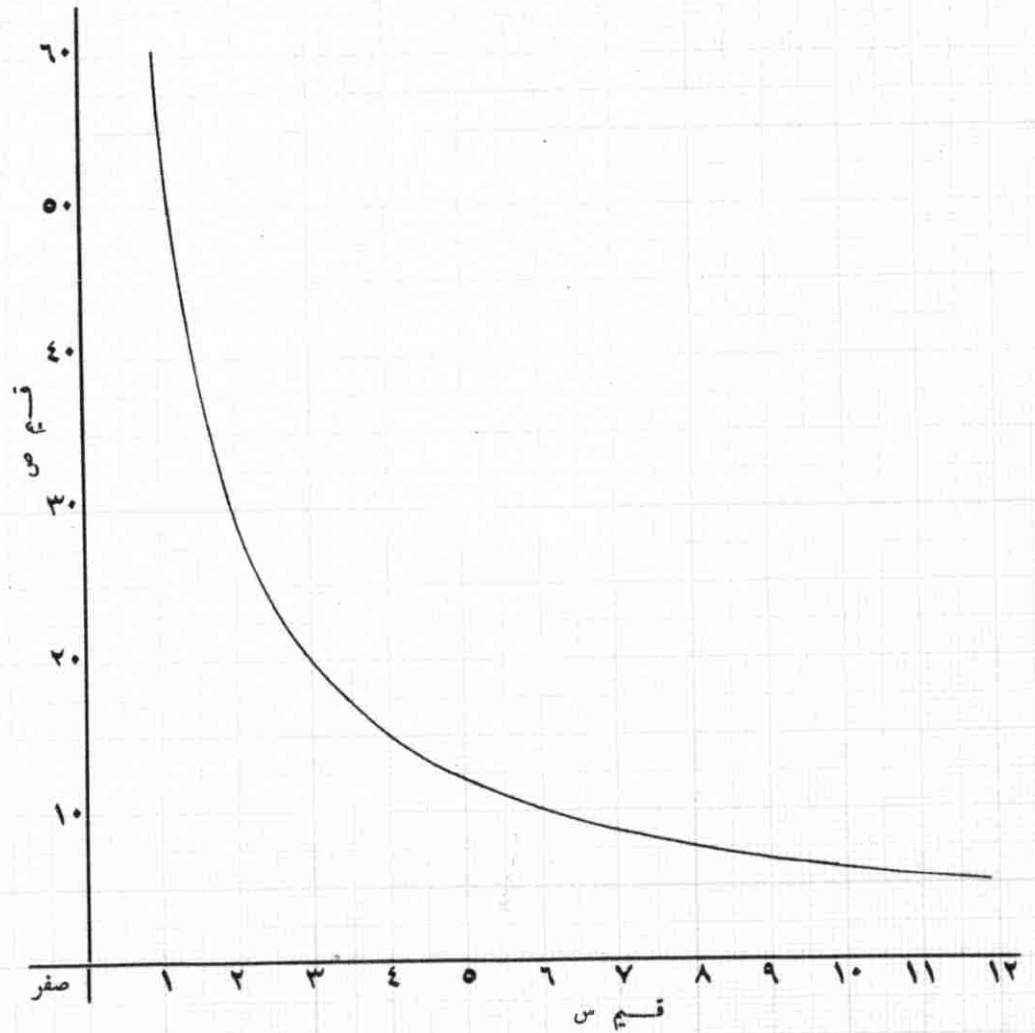
[٥٥] بمقياس رسم: ١ سم  $\equiv$  ١ ل س ، ١ سم  $\equiv$  ٢ ل ص بين النقطة س = ٢ ، ص = صفر؛ والنقطة س = ٤ ، ص = صفر

[٥٦] بنفس مقياس الرسم في السؤال ٥٥ بين النقطة س = صفر ، ص = ٥ ؛ والنقطة س = صفر ، ص = ١١ .

[ ٥٧ ] على المحورين التاليين بتين النقطة س = ٢ ، ص = ٥ والنقطة س = ٤ ، ص = ١١ . - 90 -



اجب على الاسئلة ٥٨ ، ٥٩ ، ٦٠ من الرسم البياني التالي



| الاجابة                           | ق س | ص  |
|-----------------------------------|-----|----|
| $12 \left(\frac{1}{2} \pm\right)$ | 2   | 58 |
| $3 \left(\frac{1}{2} \pm\right)$  | 2   | 59 |
| تنقص (أو تتزحف)                   | 2   | 60 |

[ ٥٨ ] ما قيمة ص عندما تكون س = ٥ ؟

[ ٥٩ ] ما قيمة س عندما يكون ص = ٢٠ ؟

[ ٦٠ ] ماذا يصير لقيم ص عندما تزيد قيم س ؟ اجب بكلمة واحدة .

نهاية الامتحان  
\* \* \* \* \*

## اختيار الاجابات الصحيحة - النوع الاول

|    |   |   |   |   |
|----|---|---|---|---|
| ٣١ | أ | ب | ج | د |
| ٣٢ | أ | ب | ج | د |
| ٣٣ | أ | ب | ج | د |
| ٣٤ | أ | ب | ج | د |
| ٣٥ | أ | ب | ج | د |

|    |   |   |   |   |
|----|---|---|---|---|
| ٢١ | أ | ب | ج | د |
| ٢٢ | أ | ب | ج | د |
| ٢٣ | أ | ب | ج | د |
| ٢٤ | أ | ب | ج | د |
| ٢٥ | أ | ب | ج | د |
| ٢٦ | أ | ب | ج | د |
| ٢٧ | أ | ب | ج | د |
| ٢٨ | أ | ب | ج | د |
| ٢٩ | أ | ب | ج | د |
| ٣٠ | أ | ب | ج | د |

|    |   |   |   |   |
|----|---|---|---|---|
| ١١ | أ | ب | ج | د |
| ١٢ | أ | ب | ج | د |
| ١٣ | أ | ب | ج | د |
| ١٤ | أ | ب | ج | د |
| ١٥ | أ | ب | ج | د |
| ١٦ | أ | ب | ج | د |
| ١٧ | أ | ب | ج | د |
| ١٨ | أ | ب | ج | د |
| ١٩ | أ | ب | ج | د |
| ٢٠ | أ | ب | ج | د |

|    |   |   |   |   |
|----|---|---|---|---|
| ١  | أ | ب | ج | د |
| ٢  | أ | ب | ج | د |
| ٣  | أ | ب | ج | د |
| ٤  | أ | ب | ج | د |
| ٥  | أ | ب | ج | د |
| ٦  | أ | ب | ج | د |
| ٧  | أ | ب | ج | د |
| ٨  | أ | ب | ج | د |
| ٩  | أ | ب | ج | د |
| ١٠ | أ | ب | ج | د |

APPENDIX F

SCORING PLAN OF THE 'TYPICAL' INTERMEDIATE  
FINAL MATHEMATICS

Note: The assignment of scores and directions for scoring are written in English.

3 points for the correct answer ONLY for each part in question 1.

$$\frac{\frac{5-12}{15}}{\frac{Y}{15}} \times \frac{2}{3} - \frac{16}{21} \times \frac{Y}{8} = \frac{\frac{1}{3} - \frac{4}{5}}{\frac{15}{15} - 1} \times \frac{2}{3} - 1 \frac{5}{16} \div \frac{Y}{8} \quad (1) \quad 1$$

$$\frac{\frac{Y}{15}}{\frac{Y}{15}} \times \frac{2}{3} - \frac{2}{3} =$$

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

3

= صفر

$$\frac{س ١٦ - س ١٠ + س ٢١}{٢٤} = \frac{س ٢}{٣} - \frac{س ٥}{١٢} + \frac{س ٧}{٨} \quad (ب)$$

$$\frac{س ١٥}{٢٤} =$$

3

$$\frac{س}{٨} \text{ (أو } \frac{٥}{٨} \text{ س)} =$$

$$١٦٠ - ١٨٠ =$$

(ج) الزاوية الخارجية

$$٢٠ =$$

$$\frac{٣٦٠}{٥٢٠} \text{ ضلعا} =$$

عدد الأضلاع

3

$$١٨ \text{ ضلعا} =$$

أو

$$\frac{16}{9} = \frac{160}{90} \times n =$$

$$2n - 4$$

$$16 = n$$

$$18 - n = 36$$

$$36 =$$

$$18 - n = 16$$

$$36 =$$

$$2n$$

$$18 =$$

$$n$$

$$18 \text{ ضلعا} =$$

عدد الأضلاع

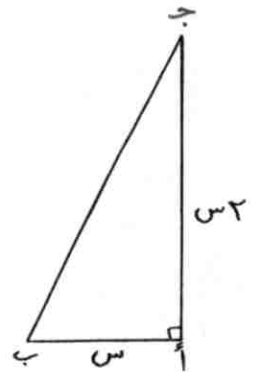
$$\frac{1}{2} = \frac{1}{2} \text{ ظا ج} =$$

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

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

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

$$\frac{25}{10} =$$



(د)

$$\frac{25}{4} =$$

(هـ)

$$\frac{25}{4} =$$



3

$$10 = \text{س}^4$$

$$2 \frac{1}{2} = \text{س}$$

أو

$$20 \text{س} = 50$$

$$\frac{50}{20} = \text{س}$$

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

15

1

٢ (أ) نفرض العدد الأصغر س

$$\begin{cases} \text{العدد الاوسط} = \text{س} + 1 \\ \text{العدد الأكبر} = \text{س} + 2 \end{cases}$$

1

ضعف العدد الأكبر =  $2(\text{س} + 2)$

١

٣ أمثال العدد الأصغر =  $3\text{س}$

المعادلة :

1

$$34 = 2(\text{س} + 2) + 3\text{س}$$

1

$$34 = 2\text{س} + 4 + 3\text{س}$$

1

$$30 = 5\text{س}$$

$$6 = \text{س}$$

2

$$\begin{cases} 6 = \text{العدد الأصغر} \\ 7 = \text{العدد الأوسط} \\ 8 = \text{العدد الأكبر} \end{cases}$$

-1 for each mistake

$$(ب) \frac{1}{4}(س-٢) - \frac{1}{7}(س٢-٥) + ١ - \frac{س٣}{٢٠} = \text{صفر}$$

1 المضاعف البسيط ل ٤ ، ٦ ، ٢٠ = ٦٠

$$+ ١ \times ٦٠ - \frac{1}{7} \times ٦٠ (س٢-٥) - \frac{1}{4} \times ٦٠ (س-٢)$$

1 صفر =  $\frac{س٣}{٢٠} \times ٦٠$

1 ١٥(س-٢) - ١٠(س٢-٥) - ٦٠ + ٩س = صفر

2 ١٥س - ٣٠ - ٢٠س + ٥٠ - ٦٠ + ٩س = صفر

$$١٥س - ٢٠س + ٩س = ٣٠ - ٥٠ + ٦٠$$

$$٤س = ٤٠$$

1 س = ١٠

14

1 ٣ (أ) مجموع النسب = ٢ + ٣ + ٥ = ١٠

2  $\frac{٥}{١٠}$  المبلغ = ٦٥ جنيها

$\frac{١}{١٠}$  المبلغ =  $\frac{٦٥}{٥}$  جنيها

المبلغ =  $\frac{٦٥}{٥} \times ١٠$  جنيها

1 = ١٣ جنيها

أو

$\frac{١}{٢}$  المبلغ = ٦٥ جنيها

المبلغ = ١٣ جنيها

1 نصيب الأول =  $\frac{٢}{١٠} \times ١٣$  جنيها = ٢٫٦ جنيها

1 نصيب الثاني =  $\frac{٣}{١٠} \times ١٣$  جنيها = ٣٫٩ جنيها

(ب) ٣ سم = ٦ كلم  
٩ سم مربع = ٣٦ كلم مربع  
المساحة على الخريطة = ٩ سم مربع

أو

٣ سم = ٦ كلم  
١ سم = ٢ كلم  
١ سم مربع = ٤ كلم مربع  
المساحة على الخريطة =  $\frac{٣٦ \text{ كلم مربع}}{٤ \text{ كلم مربع}} = ٩ \text{ سم مربع}$

٩ سم مربع = ٩ سم مربع

10

٤ نفرض رأس المال = ١ جنيه

ربح ١ جنيه في نهاية السنة الأولى =  $١ \times \frac{٥}{١٠٠} \times ١$  جنيه

٠.٥ جنيه =

رأس المال في بداية السنة الثانية = (٠.٥ + ١) جنيه

١.٥ جنيه =

ربح ١.٥ جنيه في نهاية السنة الثانية =  $١.٥ \times \frac{٥}{١٠٠} \times ١$  جنيه

٠.٥٢٥ جنيه =

ربح ١ جنيه في السنتين = (٠.٥٢٥ + ٠.٥) جنيه

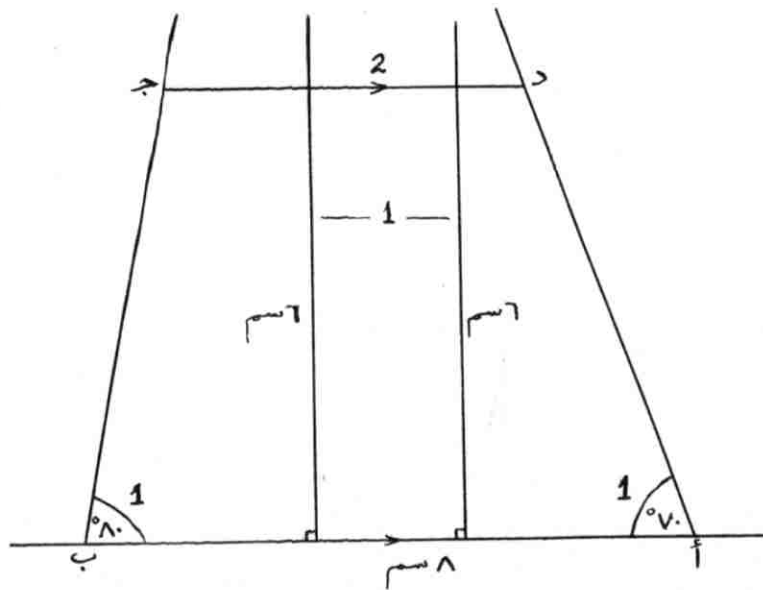
١.٠٢٥ جنيه =

رأس المال =  $\frac{\text{الربح الكلي}}{\text{ربح ١ جنيه في سنتين}}$

٣ =  $\frac{٢٠٥}{٠.١٠٢٥} \text{ جنيه}$

|   |   |             |
|---|---|-------------|
| 1 | 2000 جنيها  | - رأس المال |
|   |   | <u>أو</u>   |
| 1 | الجملة - رأس المال                                      | الربح       |
| 5 | $2 - \frac{100}{100} \times \frac{100}{100} \times 2 =$ | 200         |
| 2 | 2025 ارام -   | 200         |
| 2 | 2025 اره -  |             |
| 1 | $\frac{200}{2025 \text{ اره}} =$                        | 2           |
| 1 | 2000 جنيها  | رأس المال   |

12



2 (أ) جد = 2 اره سم (± اره سم : اره سم أو اره سم)

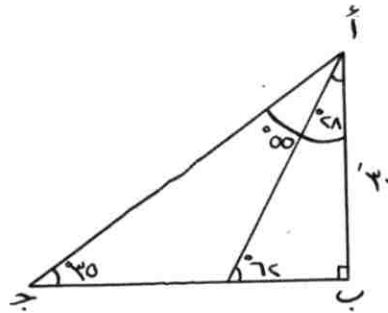
2 (ب) مساحة الرباعي أ ب ج د (شبه المنحرف) =  $\frac{(8+47) \times 6}{2}$  سم مربع

=  $127 \times 30$  سم مربع

1 =  $381$  سم مربع

(تقبل الاجابات :

10  $384$  سم مربع أو  $378$  سم مربع



1

(1)  $\triangle$  ب أ د =  $90 - 62 = 28$

1

$\triangle$  ب أ ج =  $90 - 35 = 55$

في المثلث ب أ د

1

(أ)  $\frac{\text{ب د}}{\text{ب أ}} = \text{ظا } 28$

$\frac{\text{ب د}}{30 \text{ قدم}} = \text{ظا } 28$

$\text{ب د} = 30 \times \text{ظا } 28$  قدم

1

=  $30 \times 0.4695$  قدم

1

=  $14.085$  قدم

1

(ب)  $\frac{\text{ب ج}}{\text{ب أ}} = \text{ظا } 55$

$$\frac{\text{بج}}{30 \text{ قدم}} = \text{ظا } 55^\circ$$

$$\text{بج} = 30 \times \text{ظا } 55^\circ \text{ قدم}$$

1

$$= 30 \times 4281 \text{ قدم}$$

1

$$= 128430 \text{ قدم}$$

2

$$(2) \text{ مساحة المثلث أ د ج} = \frac{1}{2} \times \text{د ج} \times \text{أ ب}$$

$$\text{د ج} = \text{بج} - \text{ب د}$$

1

$$= 128430 \text{ قدم} - 109510 \text{ قدم}$$

1

$$= 18920 \text{ قدم}$$

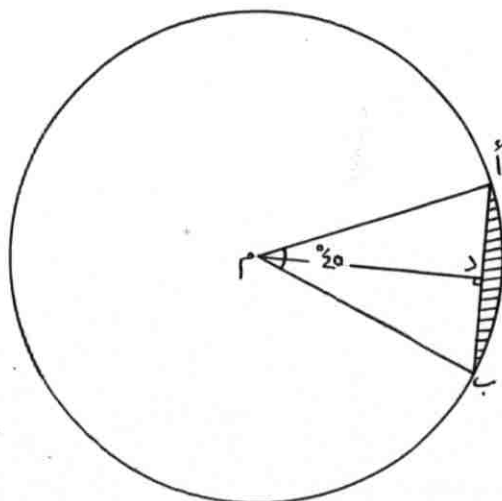
$$\text{مساحة المثلث أ د ج} = \frac{1}{2} \times 18920 \times 30 \text{ قدم مربع}$$

$$= 283800 \text{ قدم مربع}$$

1

$$= 283800 \text{ قدم مربع}$$

12



1 (أ) مساحة القطاع =  $\frac{\text{الزاوية المركزية}}{360} \times \text{مساحة الدائرة}$

$$= \frac{45}{360} \times \pi \text{ نق}^2$$

1  $= \frac{22}{7} \times \frac{45}{360} \text{ نق}^2$

1  $= \frac{11}{28} \text{ نق}^2$

1  $66 \frac{11}{28} = \frac{11}{28} \text{ نق}^2$

1  $\frac{1859}{28}$

2  $\frac{28 \times 1859}{11 \times 28} = \text{نق}^2$  سم مربع = 169 سم مربع

1  $\sqrt{169}$  سم = نق

1  $13$  سم =

1 (ب) أ ب = 10 سم

1 = 5 سم

في أي من المثلثين أ د م ه ب د م ه

1  $13^2 - 25 = 2$  م د

1  $169 - 25 = 2$  م د

1  $144 = 2$  م د

$$م د = \sqrt{144} \text{ سم}$$

1

$$= 12 \text{ سم}$$

$$\text{مساحة المثلث أ ب م} = \frac{1}{2} \times 10 \times 12 \text{ سم مربع}$$

1

$$= 60 \text{ سم مربع}$$

$$\text{مساحة الجزء المظلل} = \text{مساحة القطاع م أ ب} - \text{مساحة المثلث أ ب م}$$

$$= \frac{11}{28} \times 66 \text{ سم مربع} - 60 \text{ سم مربع}$$

1

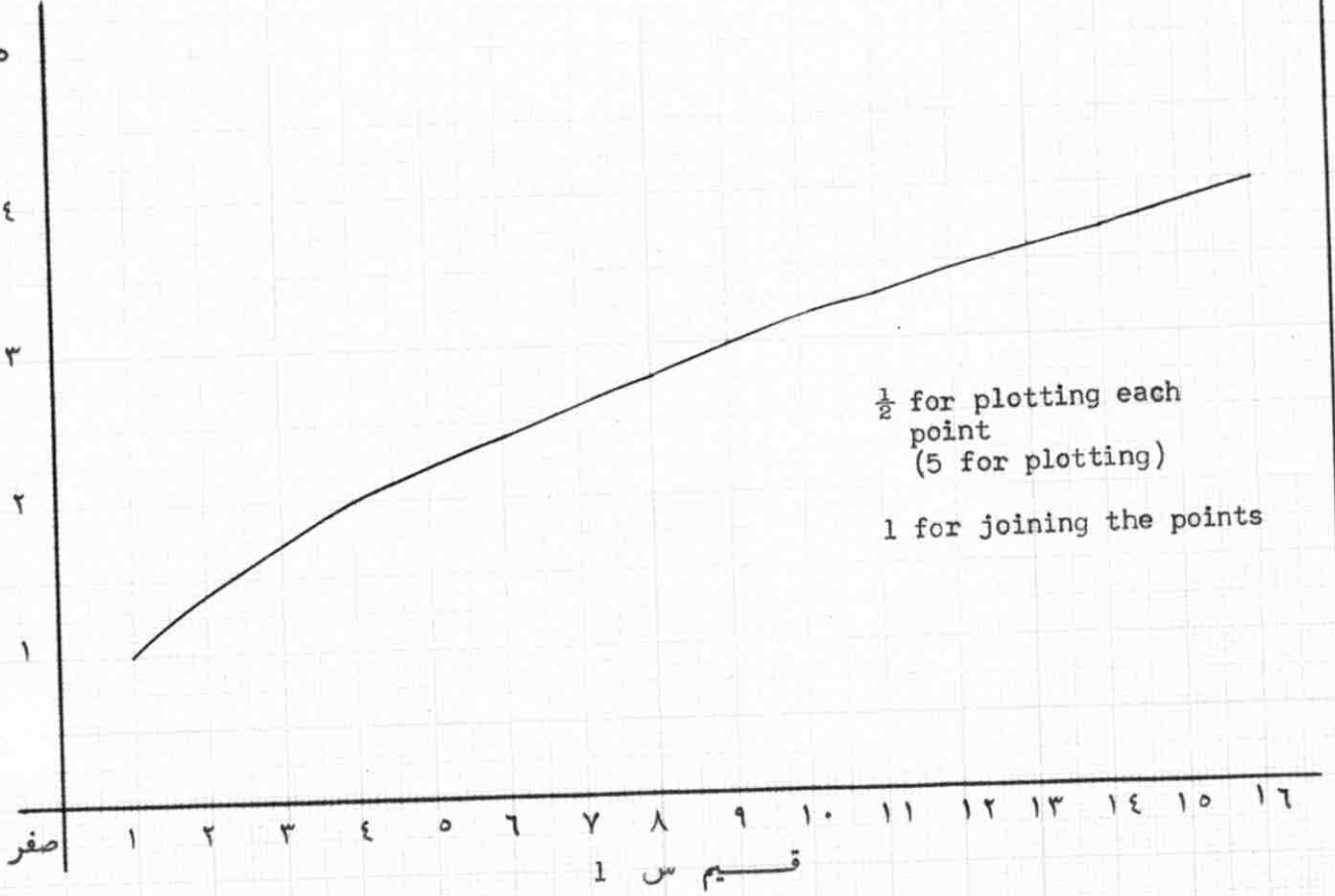
$$= 6 \frac{11}{28} \text{ سم مربع}$$

13



|    |     |     |     |   |     |     |   |     |   |   |
|----|-----|-----|-----|---|-----|-----|---|-----|---|---|
| ١٦ | ١٤  | ١٣  | ١١  | ٩ | ٨   | ٦   | ٤ | ٢   | ١ | س |
| ٤  | ٣٫٧ | ٣٫٦ | ٣٫٣ | ٣ | ٢٫٨ | ٢٫٤ | ٢ | ١٫٤ | ١ | ص |
|    |     | ١   | ١   |   |     | ١   |   | ١   |   |   |

٨ مقياس الرسم  
اسم ١ ل س  
اسم ٢ ل ص



$$\frac{1}{2} \quad (٢٫٧ - ٢٫٥) \quad ٢٫٦٥ = \sqrt{٧} \quad (١) \quad (٥)$$

$$\frac{1}{2} \quad (٣٫٩ - ٣٫٧) \quad ٣٫٨٧ = \sqrt{١٥}$$

$$\frac{1}{2} \quad (٧٫٤ - ٧٫٢) \quad ٧٫٣ = \sqrt{(٢٫٧)} \quad (٢)$$

$$\frac{1}{2} \quad (١٣٫١ - ١٢٫٩) \quad ١٣ = \sqrt{(٣٫٦)}$$

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