THE EFFECTS OF DIFFERENT INSTRUCTIONAL PROCEDURES IN TEACHING JUNIOR HIGH SCHOOL MATHEMATICS ON TYPES AND AMOUNT OF LEARNING

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THESIS

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CHAPTER I

INTRODUCTION

Introductory Comments

Like many other innovations, education had its origin with the Greeks, Romans, and early Christians in the order named. Education originated in these ancient civilizations and was first sponsored by the church. The Church, being interested in the religious life of the people, was interested in teaching the child to read and write so that he could read religious literature.

In these early schools the teaching process was that of telling and receiving by heart procedure. This type of teaching was not questioned, to a great extent, until about 1762 when Rousseau wrote his Discourse on the Origin of the Inequality of Men.

John Bernard Basedow, influenced by Rousseau, established a school in Germany based on the principles of following nature in the instruction of children.[1]

Many other educators sought to change the methods of teaching by writing and establishing schools carrying out these principles.

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[1] E. P. Cubberley, A Brief History of Education, pp.294-5.

One of the first articles written in the United States, in which the author introduced new ideas about methods of teaching, was written by Mr. Charles Pierce in 1878 and appeared under the title, "How We Make Our Ideas Clear"in the Popular Science Monthly.[2]

Presentation of the Problem and Purpose of the Experiment

Teachers and students of education today are wondering whether different methods of instruction produce a higher type of learning, and if the proper procedures are being used in our schools today. The author has conducted this experiment to try to establish a few facts on which we can base our beliefs.

The problem under consideration attempts to answer the question, Will different methods of teaching the solution of problems in finding areas and perimeters of plane surfaces produce different results; and if so, how great is the difference?

The specific procedure of this investigation may be stated as follows: (1) To give a brief introductory comment on the background of the two methods of teaching to be used in the experiment, (2) To state the problem and

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[2] Charles Pierce, "How We Make Our Ideas Clear," Popular Science Monthly, Vol. XII (January, 1878), pp.286-302.

explain how the experiment was conducted, (3) To determine the outcome of the experiment, (5) To form some tentative and possibly some definite conclusions derived from the investigation, and (6) To offer some suggestions for further study.

Explanation of the Two Methods of Instruction to Be Used

In this experiment the author does not propose to teach every subject by two separate methods, but to teach only one phase of mathematics by these methods. This phase includes the teaching of the solution of problems involving the finding of areas and perimeters of plane surfaces. One method to be used in class instruction will henceforth be called the formal method. When using this method, the teacher will set forth the formulas used in solving such problems to be memorized and the problems to be solved by them. The teacher will do his best to see that the pupils understand the problems, but he will insist on form and will use all the drill he thinks is necessary.

The other method will be called the informal method. When using this method, the teacher will not emphasize the use of the formulas set forth in most, if not all, textbooks used in our schools today. The teacher will strive to teach the students to understand why these formulas are as they are. The object in mind will be the solution of the problem and if a formula is used it will be one created by the students.

Any reader of this article who is familiar with mathematics knows when problems involving the finding of the areas of plane surfaces are solved, there is a definite formula for each figure. Each of these formulas is entirely different and with no apparent connection between them. To give an example, the formula for finding the area of a parallelogram is $A = bh$, for the rectangle $A = lw$, the square $A = s^2$, the triangle $A = \frac{1}{2} ab$, and the trapezoid $A = \frac{1}{2} a (b_1 + b_2)$. There is little, if any, similarity between these formulas, but, in reality, all of these formulas are identical. Why, then, is it necessary to memorize the formulas when all of the areas can be solved by the same formula, if a formula must be used?

When teaching the pupils to solve areas of plane surfaces by this method, the teacher will show them that the parallelogram, the square, and the rectangle are not entirely different figures, but that they are the same figure. They are all parallelograms and, since they are, their areas can be found by the formula used in finding the area of a parallelogram. Why is it necessary to call the base and height of a rectangle the length and width and of the square its sides? The length, width, and sides are only the base and altitude, as in the parallelogram.

When instruction in finding the areas of triangles is necessary, the instructor will explain that the triangle is nothing more than one half of a parallelogram and its area is found by the same method as the others except you must divide the result by two.

The teacher will show the pupils that the areas of trapezoids are just the areas of two triangles, with the same altitude and different bases, that make up the trapezoid. The usual formula for finding the area of a trapezoid can be developed right before their eyes. The instructor might also show that all the areas of the figures mentioned above can be found by the formula used in finding the area of a trapezoid. The rectangle, the square, the parallelogram, and the triangle are all special forms of the trapezoid. All of these figures, except the triangle, have four sides and the triangle is a four-sided figure whose fourth side is zero.

When teaching the students to find the perimeter of the figures mentioned above, one does not find it necessary to mention a formula. The perimeter of any straight sided figure is just the distance around it, and its perimeter can be found by adding the sides. It should not be necessary to show that some of the sides are equal because the pupil will realize this fact as soon as he has solved enough problems of this type. Why should it be necessary to give the pupils different formulas to use in finding these perimeters?

The author does not know of a textbook that treats this subject in this manner, but the reader can perceive the advantages of this method of instruction. The question arises, which method will create a better type of learning?

Some Examples of Similar Works

There have been many similar experiments carried on, and many men have written articles dealing with subjects pertinent to the one treated in this thesis. For example: Percival M.Symonds and Doris H.Chase experimented with three groups of children in the field of learning correct English usage. One group had no motivation outside the regular school routine. The second group was subjected to test motivation, and the third to intrinsic motivation. The authors say:

> We must conclude that the most effective device that can be applied to learning is to increase the amount of drill or practice. The prime function of motivation is to make this drill or practice palatable.[3]

L. W. Harding and Ines P.Bryant of Ohio State University conducted an experiment for one semester involving about sixty pupils, half of whom were in a control group. The results indicate that different instructional procedures result in different kinds of learning. The functional use of arithmetic proved as effective as drill procedures in

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[3] Percival M.Symonds and Doris H.Chase, "Practice vs. Motivation," Journal of Educational Psychology, Vol. XX (January, 1929), pp. 17-35.

developing computational skills. Direct first hand experience proved more effective than vicarious experiences and drill procedures in developing the ability to solve problems. Within certain limits, methods and materials of instruction may be more important than I. Q. in the development of certain skills and abilities.[4]

Charles H. Butler in his Doctor's Dissertation published in 1931 states:

> One of the most frequent criticisms, and probably one of the most valid criticisms, of mathematical work of children is that it is so largely mechanical. No one would deny that there are some processes which should be mechanized to a high degree of perfection, but no amount of mechanization can, in and of itself, produce an understanding of a problem situation. Yet the failure to bring about rational understanding of problem situations is precisely the charge that is being brought against mathematical instruction.[5]

On the other hand Jay Ellis Ransom writes:

> Contrary to popular belief, the basic purpose of schools in a society, is not to facilitate learning, but to teach, a priori, hard and fast rules of conduct, techniques of earning a living from a mechanical standpoint. . . . If teaching can be done by techniques of play, learning may possibly be facilitated, but in general, learning is a product of disciplined mental labor. . . . Every psychologist knows that learning at best is a painful process.[6]

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[4] Journal of Education Research, Vol. XXXVII (January,1944), pp. 321-37.

[5] Charles H. Butler, Mastery of Certain Mathematical Concepts by Pupils at the Junior High School Level, Doctor's Dissertation, The University of Missouri, 1931, p. 53.

[6] Jay Ellis Ransom, "Tuition vs Learning, A Rebuttal", Phi Deltà Kappan (December, 1943), pp. 54-56.

Daniel H. Prescott says:

> We know conclusively that academic standards and subject matter objectives are insisted upon frequently, even though they do real harm to the children. We know, too, that often school routines are adhered to in such a ritualistic fashion as to deny children the opportunities for experience or self expression that would establish their faith in themselves. . . . Is it more important that children develop adjusted, integrated personalities or that they fulfill some other traditional objectives? [7]

John Phelps Everett says:

> Enough is known. . . . to offer abundant reason for the belief that much improvement would result . . . . From a more specific recognition and emphasis upon the . . . fundamental skills of understanding. We seem reluctant to teach outright the meanings of processes. We seem to have a feeling that it is undesirable, or possibly unethical, to make frequently plain just what it is all about.[8]

Harry C. Johnson of the State Teachers College, Buffalo, New York, says:

> Educators interested in the improvement of learning in the elementary school will readily agree that the teaching of problem solving in arithmetic offers one of the greatest challenges to elementary school teachers. . . It is not at all surprising that many attempts have been made to study those factors which enter into the solution of problems and to prescribe possible remedies which might lead to an improvement in the area of learning.[9]

This experiment is another attempt to do just that.

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[7] Daniel H. Prescott, "Emotion and the Educative Process," American Council on Education, 1938, p. 137.

[8] John Phelps Everett, Contributions to Education, Number 192, Bureau of Publications, Teachers College, Columbia University, 1925.

[9] Harry C. Johnson, "Problem Solving in Arithmetic: A Review of Literature I," The Elementary School Journal (January, 1944), pp. 396-403.

Limitations of the Experiment

The following experiment is limited. First, the experiment covers only one phase of school work, that of mathematics, and deals only with one specific part of that subject. Second, the number of children involved is small, perhaps too small to establish any definite conclusions. The experiment was carried on in one school and not in several schools over a wide area. Third, the problems solved were not taken directly from and applied to the individual pupils involved. The author feels sure the reader will discover other limitations not mentioned here.

Sources of Data

The writer had access to the Kemp Public Library of Wichita Falls, Texas, the Hardin Junior College Library, and the North Texas State Teachers College Library. Publications such as the <u>National Educational Journal</u>, <u>The Texas Outlook</u>, <u>The Mathematics Teacher</u>, and others supplied some worthwhile information. Other data were obtained from two groups of eighth grade mathematics students upon whom the experiment was made. Valuable information and suggestions were obtained from personal conferences with James H. Dougherty, G. A. Odam, and J. F.Webb, professors of Education, North Texas State Teachers College, and T. B. Parnell, principal of the school in which the experiment was conducted. Miss Ruth Wilson, mathematics teacher in Reagan Junior High School, Wichita Falls, Texas, and H. D. Fillers, Superintendent of Schools, Wichita Falls, Texas, contributed greatly in the collection of the data.

CHAPTER II

THE EXPERIMENT ITSELF

The purposes of this chapter are first, to give the sources of data, second, to describe the tests used in the work, third, to explain the manner in which the tests were administered and scored, and fourth, to acquaint the reader with the exact procedure used in setting up the experiment.

Means of Evaluation

The tests used to equate the two classes were the Terman-McNemar Test of Mental Ability, Form C, by Lewis M. Terman and Quinn McNemar, both of Stanford University and the Compass Survey Tests in Arithmetic, Form A, by Greene - Knight-Ruch-Studebaker. The Mental Ability Test is published by the World Book Company, Yonkers, New York, and the Survey Test by Scott, Foresman and Company, Chicago, Illinois.

All other tests used during the experiment were composed by the author with the aid of Miss Ruth Wilson, another mathematics teacher in the school where the experiment was conducted. (See Appendix for samples.)

The mental ability test, the arithmetic survey test, and a short test on solving problems involving areas and perimeters of plane surfaces were given the students before the classes were equated. These tests were administered to aid in equalizing the two groups.

All tests given during the experiment were administered by the author and scored by him with the aid of Miss Wilson.

Experimental Procedure

Two classes in eighth grade mathematics, designated as Class 1 and Class 2, were used in this investigation. Class 1 contained, at the beginning of the experiment, twenty-seven pupils, while Class 2 contained twenty-five pupils. The results of such an experiment are more reliable if the two groups are of approximately the same ability. In an effort to equate the two groups, the following factors were taken into account:

1. Intelligence quotient
2. Score made on the short test on finding areas and perimeters of plane surfaces
3. Score made on an arithmetic survey test.

The pupils were assigned ranks on these three different items, and the ranks were averaged. The pupils' names were arranged in the reverse order to the magnitude of their average rank on the three items. The pupil of highest rank was assigned to Class 1, the second and third to Class 2, and the fourth to Class 1. In the second group of four the first was assigned to Class 2, the second and third to Class 1, and the fourth to Class 2. The odd pupils were assigned according to their rank, the lowest to Class 2 and the others to Class 1.

By the above method the pupils were divided into two classes of about the same ability. This plan of division has an advantage over that of assigning alternate pupils to each of two groups because when the latter procedure is followed, the group receiving pupils 1, 3, 5, 7, etc. is certain to be somewhat stronger than the other, since its pupils are respectively stronger than pupils number 2, 4, 6, 8, etc.

After equating the classes, the author taught the two classes for a full semester of four and one half months. Class 1 was taught by the formal method and Class 2 by the informal method when the solution of problems involving the use of formulas in finding areas and perimeters of plane surfaces arose. These methods have been explained in the preceding chapter.

At the end of approximately two months Test 2 was given each group. After a period of about two more months, during which time very little instruction in finding areas and perimeters occurred, Test 3 was administered. The object of this test was to determine which group, if either, retained the knowledge the longer. After Test 3 was given, Class 1 was taught by the informal method for one class period. Both classes then were given Test 4.

The results of all these tests are recorded in the following chapter on interpretation and evaluations.

This experiment was carried on in the Reagan Junior High School of Wichita Falls, Texas, during the fall semester of the 1944-45 school year with the permission of Mr. T.B. Parnell, principal, and Mr. H. D.Fillers, Superintendent of Schools. The students in this school, for the most part, came from families of moderate means. The school includes the eighth and ninth grades only.

CHAPTER III

INTERPRETATION AND EVALUATION

This chapter is included to put in a nutshell all the results found by the experiment and to compare these results. The results of all the tests administered are given in the following tables and a comparison of these results is included.

Tabulated Results

The following table shows the results of the Mental Ability and the Arithmetic Survey tests given the classes. This table shows the classes after they were equated.

Table 1 shows the results of the Mental Ability and Arithmetic Survey tests administered to each of the pupils in the two classes. The reader can see that the classes were equated according to the intelligence and arithmetical ability of the pupils. The mean scores were included to give the reader a better view of the equality of the two groups. The author, as mentioned before, taught Class 1 by the formal method and Class 2 by the informal method.

The following table shows the results of the three tests on the problems to be solved involving areas and perimeters of plane surfaces. These tests were given at

TABLE 1

COMPARATIVE SCORES OF THE EQUATED GROUPS ON THE TERMAN-McNEMAR TEST OF MENTAL ABILITY AND THE COMPASS SURVEY TEST IN ARITHMETIC

Class 1			Class 2		
Pupils	I. Q.	Survey	Pupils	I. Q.	Survey
1	123	87	1	111	65
2	110	82	2	110	89
3	107	89	3	110	61
4	104	81	4	109	78
5	104	89	5	106	69
6	100	93	6	101	71
7	99	73	7	99	58
8	99	68	8	99	99
9	95	60	9	95	81
10	93	70	10	95	90
11	91	81	11	91	98
12	91	88	12	90	78
13	88	84	13	88	76
14	87	47	14	87	66
15	86	65	15	85	82
16	80	68	16	80	70
17	79	75	17	80	63
18	78	78	18	80	62
19	75	68	19	78	88
20	74	81	20	77	53
21	73	32	21	77	68
22	72	50	22	70	70
23	67	58	23	70	58
24	66	48	24	65	36
25	66	47	25	53	45
26	61	66			
27	60	61			
Median	87	70		88	77
Mean	86.1	69.7		87.7	70.9

various times during the experiment. Test 1 was given at the beginning of the experiment; Test 2 two months later, and

Test 3 about two months after Test 2 was administered. Test 1 indicates the ability of the pupils to solve this particular type of problem.

TABLE 2

COMPARATIVE RESULTS OF THE FIRST THREE TESTS ON SOLVING AREA AND PERIMETER PROBLEMS GIVEN THE TWO GROUPS

Class 1				Class 2			
Pupils	Tests			Pupils	Tests		
	1	2	3		1	2	3
1	50	87	70	1	50	90	70
2	20	55	70	2	40	80	80
3	70	80	80	3	50	90	70
4	30	70	20	4	30	88	60
5	40	80	50	5	60	90	80
6	60	98	60	6	40	90	90
7	50	77	20	7	40	100	90
8	40	65	70	8	70	100	80
9	0	55	20	9	70	100	80
10	40	65	50	10	70	100	100
11	50	80	80	11	30	100	90
12	70	100	60	12	50	100	80
13	70	98	100	13	60	80	70
14	40	55	60	14	40	70	100
15	60	61	70	15	40	100	90
16	30	80	50	16	20	50	70
17	20	93	80	17	50	100	90
18	30	80	90	18	20	90	80
19	60	100	80	19	50	100	80
20	50	98	70	20	30	100	90
21	0	13	0	21	10	90	70
22	20	90	70	22	40	80	80
23	30	58	90	23	30	W	W
24	10	50	10	24	20	50	10
25	20	80	70	25	10	40	60
26	40	38	40				
27	40	80	80				
Median	40	80	70		40	90	80
Mean	38.5	72.4	59.6		40.4	86.6	79.3

This test affords an excellent means of comparing the progress of each group. Test 2 was used to establish this progress. Test 3 was given to determine, if possible, which group retained the knowledge the longer.

As the reader can see, each group was about equal in intelligence, arithmetical ability, and in the solution of problems at the beginning of the experiment. Class 1 had a mean intelligence quotient of 86.1, in arithmetical ability of 69.7, and in the ability to solve this particular type of problems 38.5. Class 2 had a mean intelligence quotient of 87.7, in arithmetical ability 70.9, and in the ability to solve the problems involved 40.4. In many cases the ability in arithmetic compared favorably with the intelligence of the pupil, but in some cases the indications were that the I. Q. did not necessarily indicate the ability of the pupil to solve problems. To offset this discrepancy the author divided the groups according to both the I. Q. and arithmetical ability.

Comparison of Results

The results of Test 2 shown in Table 2 indicate that there is a definite difference in the progress of the pupils in the two classes. First, the mean on each of these tests are 72.4 for Class 1 and 86.6 for Class 2. This is a difference of 14.2 points. The results show that the brighter pupils will learn by either method, but those of average ability or lower will improve more when they are taught informally. In Class 1 there were only two perfect scores, and these were made by pupils who had previously shown their ability in the solution of problems by making a score of 70 and 60 on Test 1. On Test 2 there were ten perfect scores made by the pupils of Class 2. Those pupils of greater ability all made perfect scores except one. This pupil made 60 on Test 1 and 80 on Test 2. The seven remaining pupils, who made perfect scores on Test 2, made scores of 30, 30, 40, 40, 50, 50, and 50 on Test 1. In many other instances the progress of the pupils in Class 2 was definitely better than that of the pupils in Class 1.

The results of Test 3, which was administered shortly after Test 2, are shown in Table 2. The purpose of Test 3 was to establish which type of instruction would produce a learning situation that would enable the students to retain the knowledge the longer.

The mean on Test 3 for Class 1 was 59.6, and for Class 2 it was 78.3. This shows a difference in ability of the classes of 18.7. The results of Test 3 show a loss of 12.8 points from the score on Test 2 for Class 1 and 8.3 points for Class 2. This leads to the assumption that the pupils in Class 2, on the average, retained 4.5 points more knowledge of the solutions of the problems than did those in Class 1.

There are other interesting comparisons of the results of this test. It is evident that most of the pupils in both classes did not retain all the knowledge, but in most of the cases in Class 2 this loss was about ten per cent while in Class 1 this loss varied considerably. If it were not for a few exceptions, the difference in the average scores would have been more impressive. Ten pupils in Class 1 either made the same score or higher than they made on Test 2, while eight pupils in Class 2 made the same or a higher score. This figures about 37 per cent in Class 1 and about 32 per cent in Class 2. This is the only instance in which the class taught informally surpassed the other class.

Twelve pupils in Class 1 scored less than 70 on Test 2, while only three pupils in Class 2 made a grade less than 70. This shows 44.4 per cent of Class 1 as failing to attain a score of 70. Twelve per cent of Class 2 failed to attain that mark. Only three pupils in Class 1 made a score of 90 or better, while in Class 2 nine pupils made 90 or better. This represents 11.1 per cent of Class 1 and 36 per cent of Class 2.

The reader probably can see other interesting comparisons of the results, but all of them will lead to certain conclusions. These conclusions will be brought out in detail in the following chapter.

The following table shows the results of the test given to both classes after informal instruction had been given to Class 1. Please keep in mind that the instruction given

Class 1 informally was brief. Test 4 was administered about five days after the last instructions.

TABLE 3

COMPARATIVE RESULTS OF THE FINAL TEST ON AREA AND PERIMETER PROBLEMS GIVEN THE TWO GROUPS AT THE END OF THE EXPERIMENT

Class 1		Class 2	
Pupils	Score	Pupils	Score
1	100	1	70
2	80	2	90
3	100	3	90
4	100	4	80
5	60	5	100
6	100	6	90
7	10	7	90
8	90	8	100
9	60	9	100
10	100	10	100
11	90	11	70
12	100	12	100
13	100	13	100
14	90	14	100
15	60	15	100
16	100	16	70
17	100	17	90
18	90	18	90
19	100	19	80
20	100	20	100
21	W	21	70
22	90	22	100
23	90	23	W
24	50	24	50
25	70	25	W
26	70		
27	90		
Median	90		90
Mean	83.8		88.2

This last test was given to strengthen the evidence already obtained by administering the other tests given during the experiment. The results of this test seem to clinch the fact that the methods used in teaching this particular field of mathematics do produce different results.

Let us compare the results obtained here with those in previous tests. On test 1 the pupils in Class 1 made 38.5 mean score; on Test 2 they made a mean score of 72.4, on Test 3, 59.6, and on this fourth and last test 83.8. This score is 11.4 per cent better than the score made on Test 2, which was given after several weeks of instructions by the formal method. On this same test Class 2 made a mean score of 88.2. Class 2 made 4.4 points higher on this test than Class 1, which seems to indicate that Class 2 is a little better than Class 1. This might be accounted for in that Class 2 had been taught by the same method all of the time, and there had been no attempt to teach them by a different method. Another cause for this discrepancy might be in that Class 1 was given very little instruction informally.

Eleven pupils in Class 1 made a perfect score on Test 4, while on any of the other tests there were, at most, only two perfect scores. There is also definite evidence of improvement in both classes when the scores of Test 4 are compared with those of Test 3. Class 2 improved 9.9 points while Class 1 improved 34.2 points. The reader can possibly see other comparisons that are not mentioned here.

From all these results and comparisons there will be some definite conclusions to be made. These conclusions and other items of interest will be discussed in the following chapter.

CHAPTER IV

SUMMARY AND SUGGESTIONS

Summary of the Findings

In the foregoing chapters the writer has attempted five definite purposes: first, to make an introductory comment on the methods of teaching to be used in the experiment; second, to present the problem and explain the purpose of the experiment; third, to give the sources of data and explain how the experiment was conducted; fourth, to tabulate and compare the results obtained; and fifth, to show that different instructional procedures do produce different types and amount of learning.

The results obtained from the tests and tabulated in a previous chapter reveal: that Class 2, the experimental group, rated 14.4 higher, on the average, than Class 1, the control group, on Test 2 given after instruction on the solution of problems involving the finding of areas and perimeters; that Class 2 scored 18.7 points higher than Class 1 on Test 3 which was given sixty days later than Test 2; that Class 2 rated 8.3 points lower on this test than on Test 2 while Class 1 rated 12.8 points lower. This indicates that Class 2 retained 4.5 points more of the knowledge obtained than Class 1. Other revelations are: that 44.4 per cent of

Class 1 failed to obtain a score of 70 or more on Test 2, while 12.0 per cent of Class 2 failed to make this score; that approximately 37 per cent of Class 1 and 32 per cent of Class 2 either made the same or a higher score on Test 3 than on Test 2; that Class 1, after informal instruction, rated 11.4 points higher on Test 4 than on Test 3; that Class 2 rated 4.4 per cent better than Class 1 on the same test, and that eleven pupils in Class 1 made a perfect score of Test 4. There had been, at most, two perfect scores on any one of the other tests.

Some Tentative Conclusions

The results of this experiment lead to some tentative conclusions: (1) that different methods of teaching this branch of mathematics do produce different types and amount of learning; (2) that the informal method of teaching produces a superior type of learning to that produced by the formal method; (3) that pupils of greater abilities will learn by either method, but those of lesser abilities learn more rapidly when taught informally; (4) that the I. Q. of a pupil does not, in all cases, indicate that the pupil can or can not learn a certain subject matter; and (5) that an understanding of the problem and its solution is a prerequisite to a good learning situation.

Suggestions for Further Study

The writer suggests that a similar experiment be conducted in other phases of mathematics and in other studies with a larger number of sutdents involved covering a wider area. The author suggests, also, that some author of a mathematics text include this method after its merits have been definitely established.

APPENDIX

TERMAN–McNEMAR TEST OF MENTAL ABILITY

By Lewis M. Terman
Stanford University, California

and Quinn McNemar
Stanford University, California

C

TEST: FORM C

Name . . . .

Date of birth . . . .
Month Day Year

Age . . . . Grade . . . . Boy . . . . Girl . . . .

School . . . .

City . . . . State . . . .

Teacher . . . . Date . . . .

Test	Score
1	
2	
3	
4	
5	
6	
7	
Total	
MA	
IQ	

Study the examples below in order to see how the answer spaces should be marked to indicate the correct answers.

1. Steel is made from
1 lead 2 iron 3 tin 4 copper 5 zinc . . . . 1 — 1 2 3 4 5

The correct answer, ***iron,*** *is number 2, so the second answer space has been blackened. You mark the correct answers for the remaining samples in the same way.*

2. A horse always has
6 rider 7 stable 8 shoes 9 hoofs 10 saddle . . . . 2 — 6 7 8 9 10

3. A quart is one fourth of a
1 gallon 2 pint 3 bushel 4 barrel 5 keg . . . . 3 — 1 2 3 4 5

In taking this test, you are first to decide which answer is correct, and then blacken with a soft *pencil* the answer space which is numbered the same as your choice for the correct answer. Make your mark as long as the pair of lines, and move the pencil up and down firmly to make a **heavy black** line. If you change your mind, erase your first mark completely.

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TEST 7. BEST ANSWER

Read each statement and mark the answer space which has the same number as the answer which you think is BEST.

SAMPLE. We should not put a burning match in the wastebasket because
1 Matches cost money. 2 We might need a match later.
3 It might go out. 4 It might start a fire. 1 2 3 4

---

1. The saying, "Idle brains are the devil's workhouse," means
1 The devil is lazy. 2 People who are idle get into trouble.
3 Many hands make light work. 4 The devil works with his brains. 1

2. The saying, "It's an ill wind that blows nobody good," means that
5 Winds bring rain. 6 That which brings misfortune to some may help others.
7 Trade winds help commerce. 8 It's easy to catch cold in a storm. 2

3. Farmers rotate crops because
1 Variety is the spice of life. 2 It confuses the plant pests.
3 It helps maintain soil fertility. 4 It gives the farmer a balanced diet. 3

4. The saying, "Little strokes fell great oaks," means
5 Continued effort brings results. 6 Oak trees are weak.
7 Little strokes are best. 8 Anyone can fell an oak. 4

5. The saying, "A miss is as good as a mile," means
1 A girl can walk just about a mile. 2 Errors are unpardonable.
3 The evil men do lives after them. 4 A failure is a failure, no matter how small. . . . 5

6. The saying, "It never rains but it pours," means
5 Salt stays dry when it rains. 6 Every cloud has a silver lining.
7 Troubles seldom come singly. 8 Storms are more frequent than showers. 6

7. The cause of echoes is
1 Static electricity in the air. 2 The reflection of sound waves.
3 The absence of anything in the air. 4 Not known. 7

8. The saying, "Look before you leap," means
5 Consider first, act afterward. 6 Trust your eyes, but not your feet.
7 Anything is right which looks right. 8 Never take chances. 8

9. The saying, "Never ride a free horse to death," means
1 Never accept free rides. 2 Never abuse privileges granted as favors.
3 One should prize anything that is free. 4 A horse is to ride, not to kill. 9

10. The saying, "If the shoe fits, wear it," means
5 Be sure to buy shoes that fit. 6 Give the devil his due.
7 Don't take unnecessary steps. 8 Recognize your own faults and virtues. 10

11. Copper is used for electric wiring because
1 It is decorative. 2 It is easily bent.
3 It retains heat. 4 It is a good conductor. 11

12. The saying, "Don't cross your bridges till you come to them," means
5 Where there's a will there's a way. 6 Everything comes to him who waits.
7 Don't anticipate possible troubles. 8 Bridges are dangerous. 12

Score . . . . . .

TEST 1. INFORMATION

Mark the answer space which has the same number as the word that makes the sentence TRUE.

SAMPLE. Our first President was
1 **Adams** 2 **Washington** 3 **Lincoln** 4 **Jefferson** 5 **Monroe**

---

1. Polo is a kind of
1 **disease** 2 **work** 3 **bear** 4 **game** 5 **language** ... 1
2. Herring is a kind of
6 **wig** 7 **flower** 8 **pattern** 9 **jewel** 10 **fish** ... 2
3. The lyre was an early instrument used in
1 **music** 2 **writing** 3 **mining** 4 **farming** 5 **sculpturing** ... 3
4. Linen is made from
6 **hair** 7 **jute** 8 **flax** 9 **rayon** 10 **latex** ... 4
5. Burlap is a kind of
1 **lumber** 2 **stone** 3 **hood** 4 **fabric** 5 **comedy** ... 5
6. Quicksilver is another name for
6 **chromium** 7 **tin** 8 **mercury** 9 **aluminum** 10 **lead** ... 6
7. The number of pounds in a ton is
1 *(1000)* 2 *(2000)* 3 *(3000)* 4 *(4000)* 5 *(5280)* ... 7
8. Chinchilla is a kind of
6 **fur** 7 **seasoning** 8 **chemical** 9 **malady** 10 **furniture** ... 8
9. The fathom is a measure of
1 **weight** 2 **curvature** 3 **hardness** 4 **depth** 5 **strength** ... 9
10. Larceny is a term used in
6 **forestry** 7 **medicine** 8 **theology** 9 **pedagogy** 10 **law** ... 10

1 ➔

11. Napoleon's final defeat was at
1 **Waterloo** 2 **Paris** 3 **Verdun** 4 **Elba** 5 **Leipzig** ... 11
12. The dynamo produces
6 **dynamite** 7 **powder** 8 **electricity** 9 **gas** 10 **steam** ... 12
13. Pasteur was a famous
1 **traveler** 2 **boxer** 3 **artist** 4 **bacteriologist** 5 **physicist** ... 13
14. The Pharaohs were kings of
6 **Babylon** 7 **Jerusalem** 8 **Syria** 9 **Greece** 10 **Egypt** ... 14
15. Sonata is a term used in
1 **drawing** 2 **drama** 3 **music** 4 **poetry** 5 **phonetics** ... 15
16. The Colosseum was an
6 **amphitheater** 7 **aqueduct** 8 **aquarium** 9 **archway** 10 **army** 16
17. The larynx is in the
1 **abdomen** 2 **throat** 3 **head** 4 **ear** 5 **pelvis** ... 17
18. Among birds that migrate widely are
6 **eagles** 7 **cardinals** 8 **owls** 9 **robins** 10 **quail** ... 18
19. Emeralds are usually
1 **red** 2 **yellow** 3 **green** 4 **purple** 5 **blue** ... 19
20. Sirloin is a cut of
6 **mutton** 7 **beef** 8 **veal** 9 **lamb** 10 **pork** ... 20
21. The head of a museum is called a
1 **musician** 2 **curator** 3 **mortician** 4 **pastor** 5 **collector** ... 21
22. A six-sided figure is called a
6 **pentagon** 7 **hexagon** 8 **sextet** 9 **helix** 10 **scholium** ... 22
23. The bat is most closely related to the
1 **butterfly** 2 **swallow** 3 **owl** 4 **mouse** 5 **moth** ... 23
24. A character in "David Copperfield" is
6 **Tiny Tim** 7 **Uriah Heep** 8 **Scrooge** 9 **Goliath** 10 **Darnell** 24
25. Quinine comes from
1 **leaves** 2 **roots** 3 **medicine** 4 **minerals** 5 **bark** ... 25

Score

TEST 6. OPPOSITES

Mark the answer space which has the same number as the word which is OPPOSITE, or most nearly opposite, in meaning to the beginning word of each line.

SAMPLE. north — 1 hot 2 east 3 west 4 down 5 south . . . .

1. exit — 1 emit 2 transcend 3 entrance 4 origin 5 arrival 1
2. amateur — 6 novitiate 7 musical 8 professional 9 inventor 10 experience 2
3. genuine — 1 stolen 2 counterfeit 3 sincere 4 original 5 unworthy 3
4. abundance — 6 liberality 7 frugality 8 luxury 9 hunger 10 scarcity 4
5. alert — 1 illiterate 2 pert 3 sluggish 4 disabled 5 easy 5
6. waste — 6 refuse 7 conserve 8 devastate 9 dole 10 generate 6
7. humiliated — 1 honored 2 refreshed 3 satisfied 4 lively 5 arrogant 7
8. gravity — 6 fragility 7 specificity 8 purity 9 constancy 10 levity 8
9. limitation — 1 explanation 2 encouragement 3 ability 4 freedom 5 speed 9
10. monotony — 6 difficulty 7 diversion 8 harmony 9 repetition 10 variety . . . 10

6➔

11. obtuse — 1 accessible 2 abstruse 3 acute 4 corpulent 5 agile 11
12. expel — 6 remain 7 propel 8 exile 9 retain 10 contract 12
13. asset — 1 bankruptcy 2 descent 3 misery 4 mortgage 5 liability 13
14. acid — 6 alkaline 7 neutral 8 pepsin 9 briny 10 chemical 14
15. eccentric — 1 particular 2 stupid 3 egocentric 4 ordinary 5 virtuous 15
16. disperse — 6 approve 7 remove 8 gather 9 spare 10 whisper 16
17. wax — 1 pale 2 waive 3 shine 4 age 5 wane 17
18. blithe — 6 helpless 7 cheerless 8 stingy 9 lazy 10 slow 18
19. active — 1 past 2 careless 3 passive 4 pensive 5 dull 19
20. depress — 6 press 7 elate 8 oppress 9 exhort 10 climb 20
21. concede — 1 deny 2 recede 3 finesse 4 usurp 5 resign 21
22. recline — 6 succumb 7 stretch 8 erect 9 stand 10 decline 22
23. invincible — 1 susceptible 2 weak 3 stubborn 4 visible 5 broken 23
24. rash — 6 prudent 7 worthy 8 smooth 9 irrational 10 stringent 24
25. defile — 1 confess 2 file 3 excel 4 purify 5 beautify 25

Score . . . . .

TEST 2. SYNONYMS

Mark the answer space which has the same number as the word which has the SAME or most nearly the same meaning as the beginning word of each line.

SAMPLE. correct — 1 neat 2 fair 3 right 4 poor 5 good 1 2 3 4 5

1. comic — 1 clumsy 2 laughable 3 universal 4 tricky 5 peculiar 1
2. hazardous — 6 adventurous 7 hard 8 annoying 9 speedy 10 dangerous 2
3. comfort — 1 entreat 2 console 3 pity 4 anger 5 discourage 3
4. equip — 6 decorate 7 establish 8 surround 9 load 10 furnish 4
5. introductory — 1 social 2 advisory 3 transitory 4 preliminary 5 internal .. 5
6. writhe — 6 squeal 7 twist 8 split 9 hurt 10 crawl 6
7. trivial — 1 amusing 2 rare 3 unimportant 4 detailed 5 uneven 7
8. evade — 6 vacate 7 invade 8 shun 9 hide 10 desist 8
9. denounce — 1 beguile 2 detest 3 inform 4 discover 5 condemn 9
10. opposed — 6 censored 7 adverse 8 involved 9 oppressed 10 morose .. 10

2➔

11. counsel — 1 quarrel 2 yield 3 advise 4 assemble 5 represent 11
12. abhor — 6 detest 7 fear 8 avoid 9 defy 10 disgust 12
13. depict — 1 vanish 2 slump 3 portray 4 edit 5 fabricate 13
14. expel — 6 repel 7 eject 8 injure 9 expend 10 depart 14
15. encumbrance — 1 contrivance 2 memory 3 burden 4 saddle 5 prison 15
16. docile — 6 facile 7 cozy 8 agile 9 submissive 10 intractable 16
17. quell — 1 inquire 2 dispel 3 instill 4 quest 5 subdue 17
18. abandon — 6 flee 7 escape 8 refuse 9 forsake 10 refrain 18
19. jubilant — 1 exultant 2 judicious 3 playful 4 pleasant 5 jeweled 19
20. hoax — 6 danger 7 deception 8 persuasion 9 revelation 10 mischief 20
21. curdle — 1 coagulate 2 spoil 3 snuggle 4 condense 5 churn 21
22. reverence — 6 revenge 7 relevance 8 obedience 9 veneration 10 mercy 22
23. incite — 1 instigate 2 revolt 3 announce 4 disrupt 5 consume 23
24. boldness — 6 hypocrisy 7 ferocity 8 audacity 9 frankness 10 confidence 24
25. appease — 1 praise 2 pique 3 entice 4 gladden 5 placate 25

Score ......

TEST 5. ANALOGIES

Study the samples carefully.

SAMPLES.
Ear is to hear as eye is to
1 cry 2 glasses 3 spy 4 wink 5 see 1 2 3 4 5
Hat is to head as shoe is to
6 arm 7 leg 8 foot 9 fit 10 glove 6 7 8 9 10

DO THEM ALL LIKE THE SAMPLES.

1. Zoo is to animals as aquarium is to
1 birds 2 fish 3 bees 4 statues 5 butterflies 1
2. Linoleum is to floor as sheet is to
6 cotton 7 piano 8 blanket 9 linen 10 bed 2
3. Food is to hunger as water is to
1 desert 2 thirst 3 quench 4 drink 5 milk 3
4. Add is to subtract as multiply is to
6 arithmetic 7 increase 8 fraction 9 add 10 divide 4
5. Stone is to marble as wood is to
1 brick 2 soft 3 cut 4 oak 5 pile 5
6. Abide is to depart as stay is to
6 play 7 leave 8 away 9 over 10 home 6
7. Author is to book as artist is to
1 painter 2 brush 3 picture 4 easel 5 paint 7
8. You is to yours as me is to
6 his 7 ours 8 mine 9 theirs 10 my 8
9. Singing is to opera as dancing is to
1 masquerade 2 orchestra 3 movie 4 drama 5 ballet 9
10. Shell is to nut as skin is to
6 hull 7 animal 8 white 9 soft 10 cover 10

5→

11. Cub is to bear as gosling is to
1 fox 2 grouse 3 goose 4 rabbit 5 duck 11
12. Liberty is to freedom as bondage is to
6 slavery 7 free 8 suffer 9 serf 10 revolution 12
13. Imitate is to copy as invent is to
1 inventory 2 copyright 3 originate 4 machine 5 patent 13
14. 1 is to 3 as 9 is to
6 *(18)* 7 *(27)* 8 *(36)* 9 *(45)* 10 *(81)* 14
15. Complex is to simple as hard is to
1 tough 2 work 3 easy 4 smooth 5 brittle 15
16. Tree is to forest as person is to
6 women 7 couple 8 human 9 crowd 10 men 16
17. City is to mayor as army is to
1 soldier 2 navy 3 private 4 admiral 5 general 17
18. Wolf is to sheep as cat is to
6 milk 7 fur 8 kitten 9 mouse 10 dog 18
19. $\frac{4}{3}$ is to $\frac{1}{3}$ as 28 is to
1 *(7)* 2 *(14)* 3 *(33)* 4 *(34)* 5 *(43)* 19
20. Hog is to bristles as snake is to
6 fangs 7 scales 8 venom 9 coil 10 rattle 20
21. Seldom is to never as little is to
1 none 2 neither 3 small 4 often 5 large 21
22. Day is to 365 as week is to
6 *(7)* 7 *(31)* 8 *(48)* 9 *(52)* 10 *(60)* 22
23. Corrupt is to depraved as sacred is to
1 hallowed 2 Sunday 3 depressed 4 Bible 5 prayer 23
24. Square is to cube as circle is to
6 round 7 circumference 8 sphere 9 dice 10 line 24
25. Thermometer is to temperature as metronome is to
1 intensity 2 weight 3 distance 4 pressure 5 time 25

Score ......

TEST 3. LOGICAL SELECTION

Mark the answer space which has the same number as the word which tells what the thing ALWAYS has or ALWAYS involves.

SAMPLE. A cat always has
1 kittens 2 spots 3 milk 4 mouse 5 hair

1. An orchestra always has
1 violinists 2 piano 3 musicians 4 saxophone 5 singers 1
2. A museum always has
6 visitors 7 minerals 8 collections 9 guides 10 paintings 2
3. School always involves
1 children 2 students 3 arithmetic 4 geography 5 sports 3
4. A box always has
6 contents 7 wood 8 lid 9 hinge 10 depth 4
5. Contentment always involves
1 devotion 2 position 3 satisfaction 4 elation 5 recognition 5
6. A newspaper always has
6 pictures 7 editor 8 puzzles 9 fiction 10 cartoons 6
7. A wheel always has
1 circumference 2 spokes 3 tire 4 wood 5 metal 7
8. A policeman always has
6 club 7 cap 8 beat 9 uniform 10 authority 8
9. A nation always has
1 states 2 colonies 3 seaports 4 laws 5 navy 9
10. A Night always has
6 stillness 7 moon 8 clouds 9 ghosts 10 hours 10

3➔

11. A ship always has
1 engine 2 guns 3 hull 4 passengers 5 freight 11
12. A message always involves
6 telepathy 7 messenger 8 speech 9 communication 10 writing 12
13. Discipline always involves
1 revenge 2 anger 3 morale 4 whipping 5 training 13
14. A bottle always has
6 hollowness 7 label 8 cork 9 glass 10 transparency 14
15. Anxiety always involves
1 awe 2 grief 3 insomnia 4 uneasiness 5 discouragement .. 15
16. Compromise always involves
6 respect 7 friendship 8 adjustment 9 law 10 violation 16
17. An heir always has
1 money 2 lawyer 3 heirlooms 4 property 5 predecessor ... 17
18. An invention always involves
6 usefulness 7 originality 8 patent 9 value 10 imitation 18
19. A dance always has
1 music 2 partners 3 rhythm 4 audience 5 costume 19
20. A debt always involves
6 interest 7 creditor 8 mortgage 9 payment 10 worry 20
21. Rebuke always involves
1 criticism 2 help 3 resignation 4 postponement 5 despair .. 21
22. Admiration always involves
6 affirmation 7 generosity 8 flattery 9 esteem 10 love 22
23. Annihilation always involves
1 surprise 2 destruction 3 pain 4 punishment 5 vengeance 23
24. Abhorrence always involves
6 aversion 7 rage 8 fear 9 irreverence 10 nausea 24
25. Ostentation always involves
1 simplicity 2 modesty 3 wealth 4 display 5 perfection 25

TEST 4. CLASSIFICATION

In each line below, four of the words belong together. Pick out the ONE WORD which does not belong with the others, and mark the answer space bearing its number.

SAMPLES.
1 dog 2 cat 3 horse 4 chicken 5 cow
6 hop 7 run 8 stand 9 skip 10 walk

1. 1 Catholic 2 Methodist 3 Presbyterian 4 Republican 5 Baptist 1
2. 6 damp 7 wet 8 moist 9 soggy 10 soft 2
3. 1 telegraph 2 train 3 automobile 4 bicycle 5 boat 3
4. 6 often 7 seldom 8 safely 9 always 10 rarely 4
5. 1 oats 2 rye 3 wheat 4 clover 5 barley 5
6. 6 cello 7 harp 8 drum 9 violin 10 guitar 6
7. 1 Scottie 2 Holstein 3 Collie 4 Shepherd 5 Spitz 7
8. 6 digestion 7 smell 8 sight 9 hearing 10 taste 8
9. 1 pepper 2 cinnamon 3 nutmeg 4 pickle 5 mustard 9
10. 6 chapel 7 temple 8 tabernacle 9 cathedral 10 casino 10

4→

11. 1 reason 2 pity 3 joy 4 anger 5 fear 11
12. 6 arithmetic 7 geometry 8 history 9 trigonometry 10 algebra 12
13. 1 mosquito 2 ladybug 3 gnat 4 snail 5 beetle 13
14. 6 grosbeak 7 swallow 8 oriole 9 lark 10 gazelle 14
15. 1 nail 2 brad 3 awl 4 staple 5 tack 15
16. 6 large 7 tall 8 high 9 short 10 low 16
17. 1 priest 2 organist 3 minister 4 rabbi 5 bishop 17
18. 6 devotion 7 adoration 8 reverence 9 avarice 10 admiration 18
19. 1 pine 2 fir 3 maple 4 cedar 5 spruce 19
20. 6 Christ 7 Caesar 8 Moses 9 Mohammed 10 Confucius 20
21. 1 hither 2 recent 3 whence 4 near by 5 down 21
22. 6 lead 7 brass 8 iron 9 tin 10 copper 22
23. 1 verdict 2 testimony 3 subpoena 4 court 5 evidence 23
24. 6 inherit 7 lend 8 beg 9 borrow 10 earn 24
25. 1 moreover 2 besides 3 also 4 furthermore 5 however 25

Score . . . .

Standard Mathematical Service

COMPASS SURVEY TESTS IN ARITHMETIC

GREENE-KNIGHT-RUCH-STUDEBAKER

EDITED BY GEORGE W. MYERS

ADVANCED EXAMINATION, GRADES 4-8: FORM A

Name................................ Grade................ Boy or girl?..........

Age.............. When is your next birthday?.............. How old will you be then?..........

School.. Date ....
(Name) (City) (State)

SUMMARY OF PUPIL'S SCORE	PART 1—ADDITION	PART 2—SUBTRACTION	PART 3—MULTIPLICATION	PART 4—DIVISION	PART 5—PERCENTAGE	PART 6—GENERAL	TOTAL
Scores on Parts of Test							
Educational Age Equivalent							
Grade Equivalent of Score							

PART 1—ADDITION
(Time allowance: 6 minutes)

Add. (*Reduce answers where possible.*)

(1.)
8
6
3
4
2

(2.)
15 + 7 =
16 + 6 =
26 + 9 =
15 + 8 =
37 + 9 =

(3.)
967
298
573
764

(4.)
$ 1.52
49.04
197.37
.68
92.90
4.52

(Copy 5 here)

(5.)
Copy and add:
1.91 + .04 + 7.51 + .83

(6.)
$\frac{9}{14} + \frac{2}{7} =$

(7.)
$\frac{1}{12}$
$\frac{2}{3}$

(8.)
$8\frac{1}{6}$
3
$5\frac{7}{9}$

(Copy 9 here)

(9.)
Copy and add:
$\frac{2}{3} + 8\frac{2}{5} + 2\frac{1}{15}$

(10.)
Give answer in yd., ft., and in.
2 ft. 2 in.
7 ft. 4 in.
6 ft. 8 in.

Score on Part 1 = Number right =..............

End of Part 1. Do not work on Part 2 until told to do so.

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PART 2—SUBTRACTION
(Time allowance: 6 minutes)

Subtract. *(Reduce answers where possible.)*

(1.)
1297
854

(2.)
$124.63
14.98

(3.)
1.164
.659

(4.)
Fifteen dollars less $3.89 =
$..........................

(5.)
12
$7\frac{2}{3}$

(6.)
$\frac{7}{8} - \frac{1}{6} =$

(7.)
$19\frac{4}{9}$
$9\frac{1}{6}$

(8.)
$9\frac{1}{4} - 5\frac{7}{12} =$

(9.)
What must be added to 63 to make 89? ....

(10.)
2 yd. 1 ft. 6 in.
1 yd. 2 ft. 8 in.

Score on Part 2 = Number right = ...

End of Part 2. Do not work on Part 3 until told to do so.

PART 3—MULTIPLICATION
(Time allowance: 6 minutes)

Multiply:

(1.)
What is the product of nine and zero?

(2.)
$92
14

(3.)
561
107

(4.)
$\frac{2}{3}$ of 10 =

(5.)
$3\frac{7}{12} = \frac{\quad}{12}$

(6.)
$\frac{5}{6} \times \frac{7}{15} =$

(7.)
$10.53 \times 2\frac{1}{3} =$

(8.)
(Give answer in yards and feet.)
9 yd. 2 ft.
7

(9.)
740.2
60.5

(10.)
Place decimal point in each product in correct place.
(To count as correct, both answers must be correct.)
(*a*) $.05 \times .3215 =$ 16075
(*b*) $2.01 \times 4.45 =$ 89445

Score on Part 3 = Number right = ...

End of Part 3. Do not work on Part 4 until told to do so.

PART 4—DIVISION

(Time allowance: 6 minutes)

Divide:

(1.) $4\overline{)248}$

(2.) $7\overline{)450}$

(3.) $21\overline{)\$17.85}$

(4.) $36\overline{)2817}$

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

(6.) $2\frac{7}{8} \div 1\frac{4}{5} =$

(7.) $\frac{3}{8} \div 1.5 =$

(8.) 2)3 lb. 4 oz.

(9.) $6.4\overline{)\ 207.36}$

(10.) Place decimal points in quotients correctly.

(To count as correct, both answers must be correct.)

(*a*) $\begin{array}{r} 4182 \\ 53\overline{).221646} \end{array}$

(*b*) $\begin{array}{r} 4182 \\ .53\overline{)221646} \end{array}$

Score on Part 4 = Number right =..............................

End of Part 4. Do not work on Part 5 until told to do so.

PART 5—PERCENTAGE

(Time allowance: 6 minutes)

Directions: **Work as many of these exercises as you can. You may figure on the margin of this sheet. Record your answers on the dotted lines.**

1. Change the fractions below to per cents. N stands for the number:

(*a*) $\frac{7}{10}$ of N = ...% of N. (*b*) $1\frac{3}{4}$ of N = ...% of N.

2. Change the decimals below to per cents. N stands for the number:

(*a*) .55 of N = ...% of N. (*b*) .0625 of N = ...% of N.

3. Change the per cents to fractions:

(*a*) 125% of N = ...of N. (*b*) $16\frac{2}{3}$% of N = ...of N.

4. Change the per cents to decimals (not fractions):

(*a*) $7\frac{1}{2}$% of N = ...of N. (*b*) $83\frac{1}{3}$% of N = ...of N.

5. Complete the following:

(*a*) 7 = ...% of 21. (*b*) 120% of 55 = ...

(*c*) If 1.6 is 4% of a number, what is 100% of the number? ....

Turn over the page and complete Part 5.

PART 5—Continued

6. Find $6\frac{1}{2}\%$ of 935. ....

7. If 184 is 115% of a number, what is the number? ....

8. Which is larger, 52% of 920, or 150% of 318? ....

9. 940 is what % of 1175? ....

10. Goods marked at 130% of cost sell for $7.80. What is the cost? ....

Score on Part 5=Number right=....................

End of Part 5. Do not work on Part 6 until told to do so.

PART 6—GENERAL PROBLEMS

(*Time allowance: 5 minutes*)

Directions: **Work as many of these problems as you can. You may figure on the margins of this sheet. Record your answers on the dotted lines.** ***Be sure to name your answers.***

1. If candy bars cost 5¢ each, how much will 6 candy bars cost? ....

2. How much change should a woman receive if she gives $1.50 in payment for 3 lb. of meat at 42¢ per pound? ....

3. The average of the numbers 1, 3, 6, 7, 8 is....................

4. The area of a rectangle whose dimensions are 9″ and 2″ is....................

5. If $100 is borrowed at 5%, the 5% is called the....................of interest.

6. The interest on $700 for one year at 6% is....................

7. A salesman receives 6% on his total yearly sales. His quarterly sales for one year were $6245, $8150, $9455, and $6600. What was his commission for the year?....................

8. A man writes his name on the back of a check in order to cash it. The check is then said to be..

9. Show the checks, or proofs, for these examples:

(*a*) Subtract:

$$\begin{array}{r} 1386 \\ \underline{735} \\ 651 \end{array}$$

Check 9 (*a*) here

(*b*) Divide:

$$\begin{array}{r} 71 \\ 19\overline{)1349} \\ \underline{133} \\ 19 \\ \underline{19} \end{array}$$

Check 9 (*b*) here

10. A reduction on a bill for cash payment is called a..

Score on Part 6=Number right=....................

End of the test; wait quietly.

Pre-Test or Test 1

1. Find the area of a rectangle whose length is 10 inches and width 4 inches.

2. What is the perimeter of the rectangle in problem Number 1 ?

3. What is the area of an isosceles triangle whose base is 15 feet and altitude 8 feet?

4. Find the perimeter of the triangle in problem number 3.

5. Find the area of a trapezoid whose bases are 8 inches and 15 inches and the altitude is 9 inches.

6. Find the area of a square whose sides are 14 feet.

7. Find the perimeter of a square whose sides are 8 inches.

8. What is the area of a parallelogram whose base is 10 inches and height 6 inches?

9. What is the perimeter of the parallelogram in problem Number 8 if the other two sides are 8 inches?

10. Find the distance around a trapezoid if the two parallel sides are 5 inches and 10 inches and the other two sides are 12 inches and 13 inches.

Test 2

1. If your garden at home is 100 feet by 50 feet in the shape of a rectangle, find its area.

2. How long will a fence be if it were around the garden mentioned in problem 1 ?

3. How many square inches of cloth will be required to make a triangular bandage 58 inches at the base and a 24 inch altitude?

4. Find the length of a curb around a triangular flower bed whose sides are 14 feet each.

5. Find the area of a trapezoid whose bases are 10 feet and 15 feet and whose altitude is 15 feet.

6. How many square feet of carpet will be required to cover a room 14 feet on each side?

7. How many feet of wall paper border will be required for the room in problem number 6 ?

8. Find the area of a parallelogram whose altitude is 10 feet and base 15 feet.

9. Find the perimeter of a parallelogram whose sides are 15 feet, 15 feet, 26 feet, and 26 feet.

10. Find the distance around a trapezoid whose two bases are 15 inches and 20 inches and the other two sides are 13 inches and 14 inches.

Test 3

1. Find the number of square feet of wall paper required to paper the ceiling of a room whose dimensions are 14 feet by 16 feet.

2. Find the perimeter of a rectangle whose length is 25 inches and width 37 inches.

3. Find the area of a triangle whose base is 18 feet and altitude 7 feet.

4. Find the perimeter of an isosceles triangle whose sides are 19 feet long.

5. Find the area of a trapezoid whose bases are 8 feet and 21 feet and altitude 16 feet.

6. Find the perimeter of a parallelogram whose sides are 14 inches and 28 inches in length.

7. Find the area of the parallelogram in problem 6 if the altitude upon the longer side is 10 inches.

8. Find the perimeter of a square whose sides are five feet six inches in length.

9. Find the perimeter of a trapezoid if the two parallel sides are 5 inches and 10 inches and the other two sides are 18 inches and 21 inches.

10. How many inches of frame would you need to frame a picture 12 inches by 16 inches? Do not consider the waste.

Test 4

1. What is the area of the top of a school desk which is 23 inches long and 17 inches wide?

2. Mary made a school pennant in the shape of a triangle. The base of the triangle was 20 inches, and the altitude was 42 inches. What was the area?

3. A baseball diamond is 90 feet square. What is its area?

4. Find the perimeter of a baseball diamond.

5. How many feet of fencing will be needed to enclose a rectangular lot 65 feet long and 45 feet wide?

6. How many inches of fringe will be needed to go around a triangular shaped pillow 21 inches on each side?

7. Find the perimeter of the school pennant in problem number 2, if the other two sides are 43 inches each.

8. What is the area of trapezoid with bases 14 inches and 12 inches and height 8 inches?

9. How many inches of molding would you need to enclose a blackboard 40 inches on each side?

10. A cement court is to be constructed 70 feet long and 35 feet wide. How many square feet of cement will be needed for the court?

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