THE DIFFERENTIAL APTITUDE TESTS AS PREDICTORS IN EDUCATION 1 AT THE UNIVERSITY OF MANITOBA

A Thesis

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the Faculty of Education

The University of Manitoba

In Partial Fulfilment

of the Requirements for the Degree

of Master of Education

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by

David Friesen

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CHAPTER I

INTRODUCTION

It has for some time been recognized that faculties of education, teacher colleges, normal schools, in fact, most teacher training institutions have ceased to be particular in the type of students they accept. In the last decade the demand for teachers has been of such magnitude that almost any teacher who has shown some ability in classroom management has been accepted into the profession. The practice of selecting special applicants, if it ever existed, seems to have been neglected in the field of education.

However, in spite of this insatiable demand for teachers there appear at teacher training centres students who, after all the lowering of standards, still fail to make the grade. The reasons for this, as far as can be ascertained, have not been clarified. The only fact that stands out is that students who apparently have the ability and the academic achievement are unable to qualify for the teaching profession and are rejected; but this only after a year of training in the field of education. This suggests rather serious shortcomings in the selection of candidates for teacher training centres. Firstly, this represents a waste of human resources. The student spends a full year of training in a field of endeavour in which he will not be actively

employed. How much better would it be if he could be directed to the field where he would be capable of performing positively and with success. Secondly, the training of students who are not going to be active in the educational field places an unnecessary burden on the teacher training institutions. Thus it is evident that a real problem exists in the training of candidates for the teaching profession who for some reason or other fail to become active teachers. This problem needs solution.

Immediately questions arise. What is this something which some students lack which makes them fail on a teacher training course? Is its nature academic, social, personal or psychological? Can this shortcoming be isolated for further study so that incoming students could be screened in regard to it? Are there any tests available which would be able to predict which student would fail a teacher training course?

Certainly if one considers that the cost to a student for one year of university training is in the neighborhood of twelve hundred dollars, one must admit that the choice of the proper faculty is a real problem for him. Efficient selection of students and helpful direction and guidance is something that society owes its youth.

The university, too, feels the problem. Is it necessary to carry the "dead weight" of students who will

not pass the required standards? Is it necessary to expend funds by this rather inefficient selection of students for the field of education?

There is evidence that those students who enter the Faculty of Education at the University of Manitoba have sufficient intelligence to qualify for the teaching profession. Their degrees should attest to that. It seems then that some other factor may be responsible for the failure in the case of some students. Perhaps some factor in the field of aptitudes may be responsible. There seems no doubt that the whole problem is worthy of study, for, if it could be solved, it could lead to greater efficiency, economy, and success in the selection and training of teachers.

Statement of the Problem

This study approached the problem of the selection and training of teachers. In particular, it sought a means whereby it would be possible to indicate at the beginning of the term the candidate or candidates in the teacher training class who would most likely fail the course in Education I at the Faculty of Education at the University of Manitoba. Once these means had been discovered it was hoped that they would be used to advise candidates from spending time and money in a fruitless year of study, at the same time conserving time, funds, and teaching energy.

The Procedure

This research was conducted at the Faculty of Education at the University of Manitoba. The writer administered the Differential Aptitude Tests[1] to the candidates in the Faculty of Education at the beginning of the 1957-1958 term, and correlated the scores thus obtained with those obtained in the final examinations in subject-matter areas. Evidence was sought to show whether or not the Differential Aptitude Tests are capable, and if so to what degree, in determining the student or students who may not profit from taking Education I.

The Differential Aptitude Tests were administered to the Special Summer Session Students[2] at the beginning of their term in May, 1957. The scores were then correlated with the grades obtained by these students in their mid-term and final examinations. This part of the research constituted the pilot study. It was intended to familiarize the writer with the total procedure at the same time indicating somewhat the key areas of the experiment. The pilot study was treated as a self-contained experiment.

At the beginning of the regular 1957-1958 Education I

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[1] George K. Bennett, et al., The Differential Aptitude Tests, New York: The Psychological Corporation, 1952.

[2] Special Summer School Students under a new Scholarship plan to alleviate secondary school teacher shortage.

course in the Faculty of Education at the University of Manitoba the Differential Aptitude Tests were administered to the incoming students. The tabulated marks were reviewed carefully and also correlated with the mid-term and final marks obtained by these students. These relationships were shown in tabular form and were utilized in the development of regression equations. Finally, conclusions and recommendations were drawn from this study.

A review of some literature on the Differential Aptitude Tests and on prediction of success or failure in the field of education is given in Chapter II. Chapter III deals with the Differential Aptitude Tests; their purpose, design, divisions, reliability, validity and administration. Chapter IV describes the pilot study; the class, the administration of the Differential Aptitude Tests, the analysis of the scores, the mid-term and final examinations, the correlation of the two sets of marks, and the observations and conclusions arising from this study.

Chapter V describes the administration of the Differential Aptitude Tests to the Education I class of 1957-1958 at the University of Manitoba. It also describes the mid-term and the final examinations of these students. The means and the standard deviations of the eight sections of the Differential Aptitude Tests as well as those for the mid-term and final marks have been computed for the entire

group, for the male students, and for the female students. Chapter VI interprets the results of the mid-term examinations by correlating these with the Differential Aptitude Test marks of the Education I students. Chapter VII describes the computation of the correlation coefficients between the eight sections of the Differential Aptitude Tests and the various subject areas. It also shows the t-tests between the means on the Differential Aptitude Tests of the top six students and those of the lowest six students. In the final chapter the results of this research have been summarised with a note on the limitations, suggested applications, and suggestions for further research in this field.

CHAPTER II

REVIEW OF LITERATURE

Prediction of success or failure has been used in a large number of fields of human endeavour. Most of it has not been on a scientific basis, but has been based on the judgment of the predictor. The predictive variables in such cases have been purely subjective. Consider, for example, the boy voted by his class as the most likely to succeed. Statistics has given the modern researcher the tools to make prediction more accurate and scientific.

If two variables are highly related, as indicated by a high coefficient of correlation, the possibility that some sort of cause and effect relationship exists may be examined. It may be possible to predict one from the other with a fair degree of accuracy.

Most studies suggest only limited value of prediction variables, probably because there are always so many factors operative in any particular field. Analysis of the potential of predicting variables and the use of several predicting variables to predict one final result could help the investigator to arrive at a more accurate prediction.

Lindquist clearly describes the function of the correlation coefficient in the prediction of future success when he writes:

> To illustrate the significance of correlation in prediction, suppose that a special examination designed to measure "scholastic aptitude" was administered last year to each member of the freshman class upon entrance to a certain university, and that at the end of the academic year a scatter-diagram was prepared showing the relationship between the scores made on this examination and the grade-point averages earned by the freshmen during that year. Let us suppose that this relationship is fairly high and positive. Assuming that the freshman class studied is fairly representative of succeeding freshman classes, this examination could then be used in subsequent years to predict, at the time of entrance, which students would later succeed or fail in their freshman courses. On the basis of these predictions, certain students could be advised to alter their plans, or could be placed in sections in which instruction is specially adapted to the level of ability of the group taught. If more than one examination designed for this purpose had been administered to the freshmen at the beginning of the year, and if it was later shown that the scores on one of these examinations were more highly related to grade-point averages than the scores on the other examinations, then this examination would, of course, be the best to use later for purposes of prediction. Through the study of correlations, then, a selection may be made from a number of possible different bases for predicting success, not only in scholastic work, but also in many other types of activity.[1]

In this quotation Lindquist outlines a study similar to that followed in this research.

This study is, of course, not the first directly along the lines of prediction in teacher training using the Differential Aptitude Tests. A number of American

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[1] E. F. Lindquist, A First Course in Statistics, New York: Houghton Mifflin Company, 1942, p. 159.

colleges have used the devices in an effort to track down "averages" in regard to degree-seeking students. Education undergraduates, according to a study reported in the Manual for the Differential Aptitude Tests,[1] have, on the average, consistently lower scores than almost all other degree-seeking students. However, significant as this may seem, it does not throw much light on the problem here under consideration for several reasons. Firstly, the average percentile score, as indicated in the reports on the findings, gives no indication as to the minimum score needed to still be successful in a teacher-training course. Secondly, and more important for this research, these studies deal with an American situation where students embark on their education courses after junior college. This is distinctly different from the policy in Manitoba where the minimum requirement for admission to the Faculty of Education is Third Year standing in some other faculty. Thus, the research in the American colleges is not directly applicable here.

The studies reported by the Kansas State Teachers College,[2] and the State Teachers College of Oswego, New York,[3] suffer from the same two criticisms, and are also not appli-

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[1] George K. Bennett et al, Manual for Differential Aptitude Tests, New York: The Psychological Corporation, 1952, pp. 59-62.

[2] Ibid., p. 64.

[3] Ibid.

cable in the solution of the stated problem. All of these studies fail to isolate prediction variables which are significant in teacher training. They merely represent surveys of what scores on the Differential Aptitude Tests seem to represent various professional groups.

In an extensive research carried out by J. M. Kochan in "A Study in the Prediction of Teaching Efficiency" the problem has been approached from the standpoint of finding prediction variables to help in "teacher selection" and also "teacher retention". In this study Mr. Kochan does suggest that teaching success can be partly predicted. There is as yet no certain predicting variable but several do appear to have more potential in prediction of success in teaching, according to his study. Among other things Mr. Kochan points out that:

> The biserial correlation coefficients as given in Table 16 on page 93 show a significant relationship between intelligence, as measured by the ACE test, and teaching success. A biserial coefficient (r_{bis}) of .807, significant at the 3½% level, cannot be slighted. Interesting too is the finding that English Usage measures are second-best in their predictive value, with a coefficient of .458, significant at the 5% level.[1]

Once again it seems in place to point out that Mr. Kochan's study, even though very closely related to the

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[1] John Michael Kochan, "A Study in the Prediction of Teaching Efficiency," Unpublished Master's thesis, Department of Education, University of Manitoba, 1956, pp. 110-111.

study of predicting failure or success in a teacher training course, has the much broader goal of trying to predict teacher success in actual teaching. The goal of this study, however, is not to predict teaching efficiency but to find means of predicting success or failure in the course given under the name of Education I at the University of Manitoba. The scope of this study is thus narrowed down considerably in an effort to seek solution to one phase of the great problem of finding the minimum qualities necessary to be able to complete successfully the first year course in the Faculty of Education. Thus, in essence, this study is but another attempt to clarify further the somewhat nebulous concepts of teacher selection and teacher success.

CHAPTER III

THE DIFFERENTIAL APTITUDE TESTS

The Differential Aptitude Tests by George K. Bennett, Harold G. Seashore, and Alexander G. Wesman, are a comprehensive battery of eight tests designed for use in school counselling and vocational guidance. In regard to the purposes of the tests the authors say:

> The Differential Aptitude Tests were developed to provide an integrated, scientific and well-standardized procedure for measuring the abilities of boys and girls in grades eight through twelve for purposes of educational and vocational guidance. While the tests were constructed primarily for use in junior and senior high schools, they may be used also in the educational and vocational counselling of young adults out of school and in the selection of applicants for employment. They were designed to meet the expressed needs of guidance counsellors and consulting psychologists, whose advice and ideas were sought in planning for a battery which would meet rigorous standards and be practical for day-by-day use in schools, social agencies and business organizations.[1]

There can thus be a two-fold purpose in the administration of the Differential Aptitude Tests. The teacher would perhaps be more interested in the counselling service it offers in the field of education. The administrator might be more concerned with the vocational guidance it may present. If the Differential Aptitude Tests have the

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[1] George K. Bennett et al, op.cit., p. 1.

potential of being able to predict to some degree the field of activity in which any particular student would be unsuccessful, they should be used more widely. It is this predictive value of these tests that this study wishes to investigate.

The tests of the Differential Aptitude Tests measure the abilities of the candidate in eight areas. These are Verbal Reasoning, Numerical Ability, Abstract Reasoning, Space Relations, Mechanical Reasoning, Clerical Speed and Accuracy, and Language Usage in (a) Spelling and (b) Sentences.

The eight tests are independent of each other, each having its own norms and its own administration. Together they form an integrated battery of tests. The total result would give eight separate scores which can be used and interpreted individually or compiled into a profile for each student. The norms which have been published for these tests are based on the responses of over 47,000 pupils in grades eight to twelve. The norms are presented separately by grades for both boys and girls. Alternate forms A and B are available. They are equivalent in content and significance, yet each form has its own norms.

The Differential Aptitude Tests are designed especially for high school students. Changes, especially in timing, may have to be made for university graduates. It is generally agreed that for college students the ceilings

are too low resulting in incomplete differentiation between students of high ability.

It seems essential for this study to state a minimum definition for each of these eight tests. The definitions have been summarized from the manual of the Differential Aptitude Tests.[1]

Descriptions of the Differential Aptitude Tests

1. The Verbal Reasoning Test is a measure of the ability to understand concepts framed in words.

2. The Numerical Ability items are designed to test understanding of numerical relationships and facility in handling numerical concepts.

3. The Abstract Reasoning Test is intended as a non-verbal measure of the student's reasoning ability.

4. The Space Relations Test is a measure of ability to deal with concrete materials through visualization.

5. The Mechanical Reasoning Test is supposed to measure understanding of mechanical and physical principles in familiar situations.

6. The Clerical Speed and Accuracy Test is intended to measure speed of response in a simple perceptual task.

7. The Spelling Test endeavours to check on the ability of recognising correct and incorrect spellings of words.

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[1] Ibid., pp. 5-9

8. The Sentences part of the Language Usage Test is intended to measure a student's ability to distinguish between good and bad grammar, punctuation, and word usage.

The Differential Aptitude Tests attempt to measure the student's abilities in eight areas, thereby obtaining an estimate of his strengths and his weaknesses. It is commonly assumed that in most professions all of these abilities are used. However, their degree of application in a particular profession, like teaching, may vary considerably from that of another. This study may help to clarify this concept.

Administration and Time

The instructions regarding the administration of the Differential Aptitude Tests are clearly given in the manual[1] to help maintain uniformity and accuracy. Each test has its own instructions which must be read aloud by the examiner to the class. Each example must also be read aloud in its entirety. A memorandum giving information, such as group tested, date, proctors, form of test given, timing, deviations from regular procedures, and any further pertinent factors, should be prepared.

The timing of the Differential Aptitude Tests is also exactly given; the total time being three hours and six minutes. Since, in this study, the students were mostly

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[1] Ibid., pp. 15-17.

university graduates the time for the tests was changed considerably. In all the tests, except the Clerical Speed and Accuracy Test, where the full time was observed, the time was held to two-thirds of the regularly prescribed time. This will be described in greater detail later.

Scoring

The tests were conducted with hand scoring answer sheets. In scoring these tests the perforated answer keys are superimposed over the answer sheets and the number of correct responses counted. In most cases there is also a "wrongs" key which is administered in the same way. The scoring formulas are found on each answer key.

Validity and Reliability

The authors of the Differential Aptitude Tests point out that empirical validities exist for their tests.[1] However, the user of these tests must acknowledge that validity coefficients will change with a change of population. This is an important thing to watch in this study. For counseling high school students these tests may have useful validities. This cannot be stated with the same degree of certainty when they are used for prediction of vocational success for university graduates.

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[1] Ibid., pp. 38-39.

Not only are the reliability coefficients[1] given by the grade for boys and for girls, but the standard errors of measurement are also presented. These, based on fairly homogeneous groups and on a large number of samples, range from .80 to .93.

Liabilities in the Differential Aptitude Tests

Lloyd G. Humphreys[2] in his review of the Differential Aptitude Tests, reports also on a negative factor. This involved the inter-relationship between the various tests. The inter-correlation coefficients of the tests are reported to be from .60 to .62 for about twelve sets.[3] This is especially significant for this study. Professor Humphreys makes this quite clear when he points out that

> For efficiency in differential prediction, it is desirable to have a battery with low inter-correlations. While the intercorrelations in the present battery are low enough to make the battery useful, they are not as low as possible. Purer tests than several of these used here are available.[4]

The writer also found the intercorrelation coefficients between these tests for both groups tested. These have been

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[1] Ibid.

[2] Lloyd G. Humphreys, "Review of the Differential Aptitude Tests". As reported in Oscar Krisen Buros, The Fourth Mental Measurement Yearbook. New York: The Gryphon Press, 1953, p. 681.

[3] George K. Bennett et al, op.cit., p. 69.

[4] Lloyd G. Humphreys, loc. cit.

summarised in Table VIII.

TABLE VIII

INTERCORRELATION COEFFICIENTS AMONG THE EIGHT SECTIONS OF THE D. A. T.

Pilot Study(N=41)	V.R.	N.A.	A.R.	S.R.	M.R.	C.S.A.	Spell.
N.A.	.434						
A.R.	.580	.397					
S.R.	.325	.334	.486				
M.R.	.133	.361	.381	.629			
C.S.A.	.293	.376	.228	-.112	-.114		
SPELL.	.524	.301	.265	-.133	-.271	.307	
SENT.	.657	.274	.416	.040	-.210	.153	.485

Main Study(N=63)	V.R.	N.A.	A.R.	S.R.	M.R.	C.S.A.	Spell.
N.A.	.341						
A.R.	.585	.370					
S.R.	.459	.179	.493				
M.R.	.164	.274	.307	.351			
C.S.A.	.046	.238	.210	.069	-.178		
SPELL.	.438	.168	.342	.194	-.193	.293	
SENT.	.630	.175	.282	.101	-.057	.082	.515

Summary

Three separate reviews[1] of the Differential Aptitude Tests underline the potential value of this carefully developed and standardized battery. Each commends the authors for the unequalled manual which accompanies the tests, and provides the fullest information available to date. The printing, paper stock, arrangement of the whole battery, even the test items, together with the vast amount of empirical evidence in the field of validity, reliability, and studies in prediction are praised. The norms are considered very comprehensive as they represent the work from thirty different schools in various geographical sections, including smaller and larger centres.

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[1] Lloyd G. Humphreys, Ralph F. Berdie, and Harold Hechtoldt. As reported in Oscar Krisen Buros, op.cit., pp. 677-681.

CHAPTER IV

THE PILOT STUDY

The purpose of the pilot study was to familiarize the writer with the procedures which were to be followed in this research. Secondly, the pilot study was to indicate the key areas in the experiment thereby facilitating later study. It was expected that this initial work would reveal the sections of the Differential Aptitude Tests which contain predictive value for the field of education. With these ends in view, the battery was administered to the "Special Summer School Class" of 1957 at the University of Manitoba.

The Class and the Course

Out of the class of forty-four students enrolled in the Special Summer School Class, three failed to continue their studies or failed to write both the Differential Aptitude Tests and the course examinations. These were eliminated from the pilot study leaving a class of forty-one students. The class consisted of twenty-five male and sixteen female candidates for the teaching profession, whose ages varied from nineteen to forty-six years. Their academic qualifications were less varied. Thirty-one of them had their degree in one of the faculties of Arts or Science. Two had their degree in Commerce, and eight had third year standing.

Thus the class represented a fairly heterogeneous

group when considering age and experience, but a fairly homogeneous one when considering educational achievement and vocational preference. All the students were taking a special course under a new "scholarship" plan. The first part of the course which these students were taking lasted twelve weeks. It, together with two six-week summer school sessions is to be equivalent to the Education I course offered at the Faculty of Education at the University of Manitoba.

The Administration of the Differential Aptitude Tests

The battery of tests was administered in this class on May 24, 1957 under the proctorship of Dr. W. H. Lucow. The tests were given in all to forty-three students. Two of these were absent at the final examination and they were eliminated from the study in the statistical analysis. The order and time observed in the administration of the tests were as follows:

Verbal Reasoning		20 minutes
Space Relations		20 minutes
Language Usage	I	6 minutes, 40 seconds
	II	16 minutes, 15 seconds
Ten minute break		
Mechanical Reasoning		20 minutes

Clerical Speed and Accuracy	I	3 minutes
	II	3 minutes
Abstract Reasoning		16 minutes, 15 seconds
Numerical Ability		20 minutes

The time for the tests was held at two-thirds of the regular time, except for the Clerical Speed and Accuracy test, where the full time was observed.

All these tests were hand scored at the Faculty of Education and checked by the writer. The marks were recorded, the statistics computed, and the results analyzed and held for comparison with the marks of the mid-term and final examinations. Table I contains the raw scores of the students on the Differential Aptitude Tests. The first section contains the marks of the male students, the second those of the female students. The means and standard deviations for each group, as well as for the entire group, are also given.

The Mid-term and Final Examinations

The examinations, which determine whether a student will fail or pass this particular course, were set and marked by the staff of the Faculty of Education. The mid-term examinations mark the termination of a number of subject-matter areas, while the final examinations mark the end of

the first part of the Special Summer School Course in the Faculty of Education. Table II contains the marks of the students on the mid-term examinations, Table III those on the final examinations. Both tables contain comparable statistics to those in Table I.

A Monroe Calculator was used to calculate the means, the standard deviations, and the coefficients of correlation. Both accuracy and efficiency were attained to a much greater degree through the use of the machine, through which it became practical to work directly with the raw scores obtained in the various tests. Whenever any doubt as to accuracy arose in the computation of a coefficient of correlation, the scattergram method was used to substantiate the findings or locate the error. Frequent checks were made at various times on the marks already statistically analyzed.

Computation of Correlation Coefficients.

After all the marks had been recorded, the correlation coefficients between the various sets of marks were obtained. A large number of coefficients of correlation can be obtained since the Differential Aptitude Tests are in eight parts and the course examinations, in which all students took part, are in fourteen subject areas. The total result of this correlation analysis has been summarized in Table IV.

The vertical column of this table contains all the sections of the Differential Aptitude Tests. These are Verbal Reasoning, Numerical Ability, Abstract Reasoning, Mechanical Reasoning, Clerical Speed and Accuracy, Spelling, and Sentences. The subject-matter areas are represented by the letters A to X, and the average mark by Y. A stands for Elementary Science Method, B for Child Development and Primary Methods, E for Elementary Arithmetic, F for Social Studies, G for English, I for Educational Psychology, J for Speech, K for History and Philosophy, and L for Administration. These were the subjects written during the mid-term examinations of June, 1957.

Q, in Table IV, stands for Physical Education, U for History and Philosophy, W for Administration, X for Educational Psychology, and V for Health and Adolescent Psychology. Thus Table IV also includes correlation coefficients between the Differential Aptitude Tests and five subject areas, participated in by all students, and examined in the second term examinations in August, 1957.

The average mark for each student, represented by Y, includes all the marks obtained on the mid-term and second-term examinations, even those subjects in which only a part of the class participated, such as art, music, French, and Latin. These averages have been rounded to the nearest whole number.

TABLE IV

COEFFICIENTS OF CORRELATION BETWEEN D. A. T. SCORES
AND
MID-TERM AND FINAL EXAMINATION MARKS

N = 41

D.A.T.	Mid-Term Examinations									Final Examinations					Aver-age
	A	B	E	F	G	I	J	K	L	Q	U	V	W	X	Y
V.R.	.422**	.496**	.425**	.088	.401**	.457**	.160	.734**	.388*	.466**	.469**	.453**	.391*	.302	.584**
N.A.	.387*	.316*	.342*	-.040	.232	.209	.090	.343*	.202	.246	.305*	.193	.454**	-.027	.391*
A.R.	.468**	.496**	.389*	.167	.344*	.252	.161	.515**	.390*	.574**	.211	.135	.258	.430**	.525**
S.R.	.077	-.112	.079	-.060	-.022	-.153	-.203	.147	.097	.267	.055	-.041	.269	.072	.107
M.R.	.117	-.062	-.017	.081	.011	-.161	-.384*	.013	.130	.168	.014	-.149	.130	.072	-.017
C.S.A.	.321*	.421**	.400**	-.016	.127	.047	.067	.385*	.194	.252	.233	.113	.175	.146	.348*
Spell.	.115	.205	.074	.017	.279	.278	.099	.513**	.036	.134	.102	.361*	.075	.125	.239
Sent.	.420**	.688**	.550**	.196	.274	.490**	.378*	.574**	.385*	.416**	.564**	.554**	.506**	.529**	.686**

**Significant at the 1% level.

*Significant at the 5% level.

TABLE IV -- Continued

Key

V.R.	= Verbal Reasoning	F	= Social Studies
N.A.	= Numerical Ability	G	= English
A.R.	= Abstract Reasoning	I	= Educational Psychology
S.P.	= Space Relations	J	= Speech
M.R.	= Mechanical Reasoning	K	= History and Philosophy
C.S.A.	= Clerical Speed and Accuracy	L	= Administration
Spell.	= Spelling	Q	= Physical Education
Sent.	= Sentences	U	= History and Philosophy
		V	= Health and Educational Psychology
A	= Elementary Science Method	W	= Administration
B	= Child Development and Primary Methods	X	= Psychology
E	= Elementary Arithmetic	Y	= Average

Analysis of Table IV

From this particular study it can be concluded that the two tests of test battery, the Space Relations and the Mechanical Reasoning, have no significant relationship with class marks, and cannot be used for prediction purposes in this field and for a similar class. Their correlation coefficients with class marks are inconsistent, low, both negative and positive. The relationship with the average is also not significant. The coefficients of correlation here are only .107 for the Space Relations Test and -.017 for the Mechanical Reasoning Test.

The three tests, Numerical Ability, Clerical Speed and Accuracy, and Spelling do have a positive, though low relationship with the averages in class marks. The correlation coefficients are .391, .348, and .239 respectively.

The relationship of the Numerical Ability Test with the average class mark is significant at the 5% level. However, looking at the correlation of the Numerical Ability with the marks in each subject will reveal a great inconsistency, about seven of the correlation coefficients are not significant. The same is true to an even greater degree, with the Clerical Speed and Accuracy and the Spelling marks. For reasons of inconsistency and frequent low relationships as indicated by the coefficients of correlation, it can be concluded that the Numerical Ability, Clerical Speed and Accuracy, and Spelling tests are not significant enough to be used for prediction purposes. They do, however, merit further study.

Examination of the coefficients of correlation of the other three tests, Verbal Reasoning, Abstract Reasoning, and Sentences reveals a more significant relationship with the subject matter marks. Sentences and the average have a correlation coefficient of .686, Verbal Reasoning and the average .584, and Abstract Reasoning and average .525. All three are significant at the 1% level.

The Sentences test scores have very consistent co-

efficients of correlation with the class marks, only one out of the fourteen coefficients is not significant. The correlation coefficient between Sentences and (f) social studies is .196. Otherwise the coefficients run from a low of .274 to a high of .688.

Both the Verbal Reasoning and the Abstract Reasoning indicate positive relationships with marks in subject areas, but both are less consistent than the Sentences scores. However, when considering that the pass mark of a student is for a large part determined by his average mark, it becomes apparent that these three sections of the Differential Aptitude Tests show a relationship with class marks which must be investigated further.

This was done by examining the marks of the top six students with those of the lowest six as determined by the averages. On the basis of averages in class marks it was relatively simple to pick out the top six as well as the lowest six students. The scores of these students on the Differential Aptitude Tests were then recorded and statistically analyzed as shown in Table V.

Using the formula

$$t = \frac{\bar{X} - \bar{Y}}{\sqrt{\left(\frac{\sum x^2 - \frac{(\sum x)^2}{N_1} + \sum y^2 - \frac{(\sum y)^2}{N_2}}{N_1 + N_2 - 2}\right)\left(\frac{N_1 + N_2}{N_1 N_2}\right)}}$$

TABLE V

COMPARISON OF THE D. A. T. SCORES OF THE TOP SIX STUDENTS OF THE CLASS WITH THOSE OF THE LOWEST SIX STUDENTS

Raw Scores of the Top Six Students

Student	V.R.	N.A.	A.R.	S.R.	M.R.	C.S.A.	SPELL.	SENT.
5	49	31	47	61	61	65	100	78
4	45	39	38	63	60	77	98	77
24	48	40	43	43	45	77	88	68
29	35	36	25	38	22	68	90	72
31	43	36	35	30	45	89	98	60
41	40	21	35	38	30	75	92	76
Means	43.5	33.8	37.0	48.6	43.5	75.2	94.3	71.8

Raw Scores of the Lowest Six Students

Student	V.R.	N.A.	A.R.	S.R.	M.R.	C.S.A.	SPELL.	SENT.
5	26	30	20	53	32	67	64	29
6	42	24	30	21	55	72	96	48
10	26	33	4	15	33	64	94	42
12	26	31	40	50	44	82	90	37
18	46	29	35	52	52	66	98	67
20	27	17	21	55	45	61	80	49
Means	32.2	27.3	25.0	41.0	43.5	72.0	87.0	45.3

Difference between the means of the two samples

V.R.	N.A.	A.R.	S.R.	M.R.	C.S.A.	SPELL.	SENT.
11.3*	6.5	12.0	7.8	0.0	3.2	7.3	26.5**

*Significant at 5% level.

**Significant at 1% level.

the level of significance of the difference of the means of the Differential Aptitude Tests between these small samples was obtained. The results are listed in Table VI.

TABLE VI

THE LEVEL OF SIGNIFICANCE OF THE DIFFERENCE BETWEEN THE D. A. T. MEANS OF THE TOP SIX STUDENTS AND THE LOWEST SIX STUDENTS

D. A. T.	Difference in Means	t	Level of Significance
V. R.	11.3	2.60	Sig. at the 5% level
N. A.	6.5	1.737	Sig. at the 15% level
A. R.	12.0	1.970	Sig. at the 10% level
S. R.	7.8	0.229	Not sig.
M. R.	0.0	0.0	No difference
C. S. A.	3.2	0.2	Not sig.
Spell.	7.3	1.5	Sig. at the 20% level
Sent.	26.5	4.442	Sig. at the 1% level

Again the greatest predictive value lies with the three tests, Sentences, Verbal Reasoning, and Abstract Reasoning, in that order. Here there are three sections which are not significant. They are the two indicated by the correlation analysis, Space Relations and Mechanical Reasoning, plus the Clerical Speed and Accuracy test.

Conclusions

The purpose of this research was to find more or less independent tests which would have the capacity to predict marks in the final examinations in an Education I class at the University of Manitoba. To supply information in regard to that aim the following summary conclusions can be drawn from this Pilot Study.

1. Three sections of the Differential Aptitude Tests, the Mechanical Reasoning, Space Relations, and Clerical Speed and Accuracy tests do not show any significant relationship with the class marks. For this reason they cannot be used for predictive purposes in the Faculty of Education for Education I.

2. The Spelling test and the Numerical Ability test have a positive but low relationship with class marks. These will have to be investigated and studied further before they can be used or disregarded.

3. The Sentences test, the Verbal Reasoning test, and the Abstract Reasoning test show much greater relationship with the class marks. The Sentences test is most significant in both the correlation analysis and the comparison analysis of the top students and the lowest students.

4. In Table VII the sections of the Differential Aptitude Tests are listed in order of their degree of relationship with the class averages. There is almost perfect

agreement between both analyses, except with the Clerical Speed and Accuracy test.

5. From this study it is possible to conclude that a predictive value for this particular field of education exists in several sections of the Differential Tests. The sections most significant will be used in the development of regression equations which can then be used to aid in predicting success in the first year at the Faculty of Education at the University of Manitoba. They will also be held for careful comparison with the results obtained in the main study of this research.

TABLE VII

SIGNIFICANCE OF RELATIONSHIPS OF THE D. A. T. WITH THE CLASS AVERAGE

D. A. T.	Correlation Coefficients of D. A. T. with Average	t-Test
Sent.	.686**	4.44**
V. R.	.584**	2.60*
A. R.	.525**	1.97
N. A.	.391*	1.73
Spell.	.239	1.50
C. S. A.	.348*	0.20
S. R.	.107	0.23
M. R.	-.017	0.00

**Significant at the 1% level.
*Significant at the 5% level

6. Regression equations have been drawn up with the three most promising sections of the Differential Aptitude Tests, (a) the Sentences test, (b) the Verbal Reasoning test, and (c) the Abstract Reasoning test. The formula that was used was the following:

$$Y = \left(\frac{N\Sigma XY - (\Sigma X)(\Sigma Y)}{N\Sigma X^2 - (\Sigma X)^2} \right) \left(X - \bar{X} \right) + \bar{Y}$$

(a) The regression equation for predicting the average Education I final mark from the scores of the Sentences (Language Usage) test is

$$Y = .351X + 48.24$$

(b) The regression equation for predicting the average Education I final mark from the scores of the Verbal Reasoning test is

$$Y = .566X + 48.42$$

(c) The regression equation for predicting the average Education I final mark from the scores of the Abstract Reasoning test is

$$Y = .423X + 55.64$$

7. By using two separate techniques the writer developed the multiple regression equation using the scores of the Sentences, Verbal Reasoning, and Abstract Reasoning tests. This multiple regression equation was:

$$X_1' = 43.79 + .092X_2 + .202X_3 + .260X_4$$

where X_1' is the predicted average mark. X_2, X_3, X_4 are the scores on the Verbal Reasoning, Abstract Reasoning, and Sentences tests respectively. The multiple coefficient of correlation for these three tests with the average was .736.

8. The pilot study admirably served the purpose for which it was intended. The writer became thoroughly familiarized with the problem and with the statistical techniques required to gain an insight into the solution of the stated problem. The number of correlations run in the pilot study alone amounted to 148. The work of obtaining these, coupled with the problems involved in finding the significance of the difference of means between two samples, together with the development of the regression equations assisted greatly in clarifying the concepts which were vital in this research.

The pilot study also clearly indicated the areas which should be closely watched in the main study. The sections of the Differential Aptitude Tests of greatest benefit to the solution of the problem have been somewhat isolated. Others have been shown to have no significant predictive value in this one field in education. For this reason the main research could concentrate on a more specific area.

The preliminary work has also given conclusions

which could be tested in the immediate future. The regression equations were used to check on their value on the group of education students under study. They were also used in comparison with those of the experiment proper. The major study was thus approached with greater understanding due to the experience and conclusions gleaned through the pilot study. The following chapters deal in greater detail with this main research which uses the 1957 - 1958 Education I class of the Faculty of Education of the University of Manitoba as sample.

CHAPTER V

ADMINISTRATION OF TESTS TO THE EDUCATION I CLASS

The Differential Aptitude Tests were administered to the Education I class of 1957 - 1958, in a continuation of the research into variables meaningful in the prediction of success or failure in Education I at the University of Manitoba. This class was very similar to, but not exactly like the sample class observed in the pilot study.

Description of the Subjects

Altogether sixty-three students, twenty-nine male and thirty-four female, were present to write the Differential Aptitude Tests. Their ages varied from nineteen to forty-three, with an average age of close to twenty-three years. The majority of the students were close to this average age; only six students exceeded the age of thirty years.

Thirty-three of the students had a Bachelor of Arts degree; eighteen a Bachelor of Science degree; two had a degree in Fine Arts, and two in Agriculture. Six of the students had third year standing at the University, and four had second year standing. Of the sixty-three students, fifty-three had a degree from a university. The other ten were well on the way toward such a degree. Thus, on the

whole, this sample of students represented a fairly homogeneous group of Education I students.

Description of the Course

The Education I course runs through the regular university year, from September to April. The purpose of it is to provide the students with a practical, as well as theoretical background for teaching. The first term concentrates more on the elementary teaching schedule, the second term on the secondary teaching field. Thus each term has courses which intend to attain their own objectives. The whole course serves to qualify the candidate for the teaching profession on an "interim certificate" granted by the Department of Education on the successful completion of the course. Following two years of successful teaching plus two more accredited courses the applicant receives his permanent teaching certificate.

There are two sets of examinations in Education I. The mid-term marks are not as crucial in assessing failure, but they serve as a guide to both students and faculty as to the progress each student is making. The final examinations, together with the quality of the practical work determine whether the student will "pass" or "fail". Since both examinations are vital criteria regarding the work of the students, they have been included in this study.

In order to pass the final examinations a student must have an average of over sixty per cent, with no mark below fifty per cent. Possibility of failure exists as is indicated by the fact that six of the 1956 - 1957 class in Education I failed to receive clear standing.

The Administration of the Differential Aptitude Tests

On September 30, 1957, between the hours of 8:40 A.M. and 12 noon, the Differential Aptitude Tests were administered in room 10 of the Education Building to the Education I class at the University of Manitoba by Dr. W. H. Lucow, with Prof. Vidal assisting.

The time for the tests was again held at two-thirds of the prescribed time except for the Clerical Speed and Accuracy Test which received full time. The time and order of the tests were as follows:

Verbal Reasoning		20 minutes
Space Relations		20 minutes
Language Usage (Spelling)	I	6 minutes, 40 seconds
(Sentences)	II	16 minutes, 15 seconds
Mechanical Reasoning		20 minutes
Clerical Speed and Accuracy	I	3 minutes
	II	3 minutes
Abstract Reasoning		16 minutes, 15 seconds
Numerical Ability		20 minutes

Irregularities of note were the following:

(1) Candidate number 30 got mixed up in her numbers in the Language Usage II (Sentences) Test

(2) Recent arrivals from Europe were candidate 8 (1951), and candidate 21 (1953)

(3) About seven students did not take the tests because of illness or late registration in the course.

Statistical Treatment of Marks

The answer sheets were hand-scored twice before the marks of the sixty-three students were recorded on a large sheet. The marks for the male students were placed separate from those of the female students. The means of these separate groups were obtained as well as the means and the standard deviations of the entire group. All this information is contained in Table IX.

Mid-term Examinations

The mid-term or Christmas examinations were written in December, 1957. The students were examined in twelve subjects. These were Mathematics, English, Social Studies, Science, Educational Psychology and Testing, Child Development and Primary Methods, History and Philosophy, Administration, Speech, Art, Physical Education, and Music. These were practically the same subjects as those taken by the

Special Summer School Class of the pilot study.

The mid-term papers were marked by the staff of the Faculty of Education. Once more the marks were recorded on the same sheet with the Differential Aptitude Tests scores, where the similar statistics were computed. A summary of these can be found in Table X.

The Final Examinations

The final examinations, the key criterion to success or failure in Education I, were administered in the Faculty of Education during April of 1958. Once more the papers were marked by the staff of the Faculty of Education. These marks were also entered on the same master score sheet containing all the other scores of these students. A summary of these marks has been reproduced in Table XI. The subjects examined on in this examination were Speech, Health and Adolescent Psychology, Educational Psychology, Sociology, and Administration for all the students. In addition there was a Practice Teaching mark for each student. The optional subjects included Social Studies, English, German, Science, Physical Education, Art, Mathematics, Music, Home Economics, Latin and French.

The final marks which were submitted to the registrar of the university were in five major fields. They embodied the total evaluation of the students and were obtained in the

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following way.

Course 150 - Foundations of Education - This course dealt with historical, philosophical, and sociological foundations of education. The marks here were reported by the instructor.

Course 151 - Educational Psychology - Final marks were reported by the instructor.

Course 152 - Methods of Teaching School Subjects - The final mark was computed from the marks on the methods courses plus those on the options in the following manner.

First term: Average was determined by using marks of the seven methods courses plus art or music.

Second term: Average was obtained by using marks of the three best options plus those in health and speech. Where a student took an extra option his lowest one was dropped.

The final mark was the average of the averages of the first and second term.

Course 153 - Practice of Professional Skills - The mark here was arrived at in staff conference. It was based on personal observation and confidential reports of classroom teachers.

Course 154 - School Administration - The final marks were reported by the instructor of this course.

Table XII contains this set of marks. These are the ones which determine whether the student will "pass"

or "fail". It may be in order to repeat that an average of 60, with no course mark below 50, is required to obtain clear standing.

One student failed to write the final examinations. Another did not write the examinations for course 150, and thus did not receive a mark in that course. These two students were eliminated from the study, leaving a total of sixty-one students in this experiment.

Seven students failed to write the examinations in the required eight methods courses. They did not receive an official mark for course 152. In order to keep these students in the experiment their marks for course 152 were computed on the same basis as those of the other students, however, using only the marks of their six or seven methods courses which they had completed.

After all the marks had been recorded and statistically analysed, the work of correlation began. In Chapter VI attention is focussed on the significance of the mid-term marks, still preparatory to the analysis of the final marks of the 1957-1958 Education I class.

CHAPTER VI

ANALYSIS OF MID-TERM MARKS

There are several reasons for the inclusion of a correlation analysis between the marks on the Differential Aptitude Tests and the Christmas Examination marks. It must be remembered that failure in Education I, even though it may be indicated, is not determined by the mid-term marks. These can, however, act as a significant guide in the hands of the educator. What then are some values found in correlating the mid-term marks with those of the Differential Aptitude Tests.

Firstly, this correlation could further indicate the consistency with which the Differential Aptitude Tests indicate success or failure in Education I. If proof could be obtained that a significant positive relationship exists between the mid-term marks and the marks on some sections of the Differential Aptitude Tests, the latter could be used to predict failure even at the half way mark of the term. Thus this correlation could add additional proof to the thesis that some sections of the Differential Aptitude Tests have prediction potential for Education I students.

More important, however, could be the use of the mid-term examinations to check on the progress of the student whom the Differential Aptitude Tests have isolated as a

TABLE XLII

CORRELATION BETWEEN THE D. A. T. MARKS AND THOSE OF THE MID-TERM EXAMINATIONS

N = 63

D. A. T.	MID-TERM MARKS									AVERAGE	
	A	B	C	D	E	F	G	H	I	J	K
V. R.	.265*	.391**	.323*	.343**	.290*	.526**	.370**	.423**	.150	.428**	.452**
N. A.	.131	.395**	.295*	.252*	.330**	.223	.299*	.388**	.097	.314*	.303*
A. R.	.191	.255*	.262*	.216	.340**	.410**	.137	.400**	.256*	.480**	.369**
S. R.	.097	.082	.053	.141	.189	.200	.007	.098	.207	.217	.184
M. R.	-.001	-.101	.080	-.091	.081	.018	-.125	.175	-.149	.066	.068
C. S. A.	.235	.058	.110	.209	.288*	.170	.124	.014	.079	.311*	.212
SPELL.	.094	.320*	.139	.112	.202	.278*	.244	.155	.214	.323*	.265*
SENT.	.196	.439**	.338**	.325**	.217	.349**	.314*	.328**	.228	.318*	.401**

**Significant at the 1% level

*Significant at the 5% level

probable failure. Assume that the prediction equations, developed in this thesis, have been used, and a certain student has been advised that the probability of his finishing Education I successfully is not good, and assume, furthermore, that such a student still continues his studies in the Faculty of Education. At Christmas examination time his marks could then be examined in the light of their significance as to the student's progress. This could lead to a confirmation and to a further suggestion for withdrawal or to a reassessment of the student's position. If the mid-term marks could also be predicted to the same degree as the final marks, they could prove of great benefit.

For these reasons the mid-term marks of the Education I class were correlated with their scores on the Differential Aptitude Tests. The t-tests between the means of the top six and the lowest six students were also carried out.

Correlation Analysis

The correlation coefficients between the mid-term raw scores and the raw scores on the Differential Aptitude Tests were obtained the same way as in the pilot study. These have been summarized in Table XIII.

It is significant that the same three tests, the Sentences Test, the Verbal Reasoning Test, and the Abstract Reasoning Test, correlate highest with the average class marks. This confirms the findings of the pilot study. The

correlation coefficients of all three are again significant at the 1% level.

The Spelling Test and the Numerical Ability Test correlate .265 and .303 respectively, with the average class marks. Both are significant at the 5% level. The correlation coefficients of the Clerical Speed and Accuracy, Space Relations, and the Mechanical Reasoning tests with the average class marks are not significant.

t-Test Analysis of the Difference of Means

Further information became apparent in the consideration of the raw scores of the Differential Aptitude Tests of the top six students and the lowest six students. Table XIV contains a summary of this work. The t-test analysis was again used because N was the same for both small samples of students.

In this analysis the significance of the difference of the means of the top six students and the lowest six students was found to be at the 1% level for the Abstract Reasoning Test, at the 5% level for the Sentences Test, and at the 6% level for the Verbal Reasoning Test. The other differences were not significant. This information is given in Tables XIV and XV.

Table XV contains a summary of all the evidence compiled from the statistical treatment of the marks. It

TABLE XIV

D. A. T. SCORES OF THE TOP SIX STUDENTS AND OF THE LOWEST SIX STUDENTS

Leading Students	V.R.	N.A.	A.R.	S.R.	M.R.	C.S.A.	SPELL.	SENT.
12	40	29	32	67	50	70	94	60
32	45	32	40	69	37	81	100	68
33	41	30	36	45	35	66	93	73
34	38	28	37	38	40	70	90	66
45	49	40	44	50	55	72	100	88
49	40	28	39	48	37	96	96	78
Totals	253	186	228	317	254	455	573	428
Σx^2	10751	5876	8746	17523	11088	35117	54801	30882
Means	42.17	31.00	38.00	52.83	42.33	75.83	95.50	71.33

Lowest Students	V.R.	N.A.	A.R.	S.R.	M.R.	C.S.A.	SPELL.	SENT.
2	45	36	34	73	62	63	81	62
9	16	34	24	25	59	73	43	29
10	22	15	26	42	52	62	94	39
23	36	21	28	12	55	61	86	68
51	41	29	32	15	25	76	90	57
57	28	22	32	42	30	69	100	50
Totals	188	157	176	209	283	404	494	305
Σx^2	6526	4443	5240	9851	14579	27400	42742	16579
Means	31.33	26.17	29.33	34.83	47.17	67.33	82.33	50.83
Difference between means	10.84	4.83	8.67**	18.00	-4.84	8.50	13.17	20.50*

**Significant at the 1% level

*Significant at the 5% level

clearly shows the significance of the same three tests that were most promising for prediction in the pilot study.

TABLE XV

SUMMARY OF EVIDENCE OF RELATIONSHIP OF THE D. A. T. MARKS WITH THOSE OF THE MID-TERM EXAMINATIONS OF EDUCATION I STUDENTS

D. A. T.	Correlation Coefficients of D. A. T. with Average	t-Test Analysis of Top with Lowest Students
V. R.	.452**	t = 2.217
N. A.	.303*	t = 1.255
A. R.	.369**	t = 3.766**
S. R.	.184	t = 1.705
M. R.	.068	t = -.570
C. S. A.	.212	t = 1.635
SPELL.	.265*	t = 1.568
SENT.	.401**	t = 2.973*

**Significant at the 1% level

*Significant at the 5% level

Conclusions

No other conclusions need be drawn here but to indicate that the mid-term examinations seem to be predictable, in part, from several sections of the Differential Aptitude Tests. They can serve as a check on the trend of work of

particular students.

A consistent and fairly high relationship exists between the mid-term marks of the Education I students and their scores on the three Differential Aptitude Tests, the Language Usage (Sentences) Test, the Abstract Reasoning Test, and the Verbal Reasoning Test. These three tests were watched very closely in the main analysis of this research for the results obtained in the analysis of the mid-term marks were almost identical with those obtained in the pilot study.

CHAPTER VII

THE CORRELATION OF THE FINAL COURSE MARKS OF THE EDUCATION I STUDENTS WITH THEIR D. A. T. SCORES

Before turning to the correlation of the marks on the Differential Aptitude Tests with the final course marks of the 1957 - 1958 Education I students at the University of Manitoba, it may prove profitable to review the work leading up to this analysis. The purpose of the entire research has been to investigate the prediction potential of the Differential Aptitude Tests in the first year at the Faculty of Education. To this end two studies have been completed. The first one, the pilot study, indicated that only three of the eight tests of the Differential Aptitude Tests proved to be related to the course marks in this field of education. These were the Verbal Reasoning, Abstract Reasoning, and Sentences tests. Regression equations were drawn up by using the scores on these tests separately. A multiple regression equation was also computed using all three sets of scores. The multiple R proved to be fairly high at .72. N, in the first study, was 41.

Later the Christmas examination marks of the Education I students were correlated with their Differential Aptitude Tests scores. N in this case was 63. The results were very similar to those of the pilot study, with the

same three tests showing the greatest positive relationship with the class marks. The relationship of the other five tests of the Differential Aptitude Tests to the class marks was once more insignificant.

The make-up of the final marks of the Education I students has been described in Chapter VI, and it should suffice to state that they represent the total work accomplished by the students during the entire first year at the Faculty of Education. These final marks, in the five major subject areas were then correlated with the students' scores on the Differential Aptitude Tests. In addition, the correlation coefficients between the average class marks and scores on the Differential Aptitude Tests were also obtained. The results are tabulated in Table XVI. The number of students in this experiment was 61.

Analysis of Correlations

The significant positive relationship of the final class marks to the same three Differential Aptitude Tests is the primary conclusion. Verbal Reasoning and the average mark have a correlation coefficient of .385, which is significant at the 1% level. The sentences Test also correlate at the 1% level with the final average marks, the correlation coefficient is .342. Abstract Reasoning, however, correlates only at .261 with the average class marks. This

TABLE XVI

CORRELATION BETWEEN THE D. A. T. MARKS AND THOSE OF THE FINAL EXAMINATIONS

N = 61

D. A. T.	COURSE					AVERAGE
	150	151	152	153	154	
V. R.	.161	.389**	.401**	.332**	.225	.385**
N. A.	.202	.353**	.151	.099	.290*	.283*
A. R.	.098	.336**	.353**	.137	.195	.281*
S. R.	-.125	.278*	.275*	.061	.027	.161
M. R.	-.001	.350**	.082	.094	.106	.181
C. S. A.	.109	.169	.220	.127	.266*	.234
SPELL.	.078	.179	.325**	.175	.198	.243
SENT.	.165	.265*	.325**	.360**	.224	.342**

**Significant at the 1% level

*Significant at the 5% level

is significant at the 5% level. In this final study the Numerical Ability Test has a correlation coefficient of .203 with the average class marks, which is significant at the 5% level.

From these consistent results it appears that the five tests, Numerical Ability, Space Relations, Mechanical Reasoning, Clerical Speed and Accuracy, and Spelling can be discarded for prediction purposes in the field of education at the University of Manitoba. On the other hand, the Sentences, Verbal Reasoning, and Abstract Reasoning tests have prediction potential in this field. The magnitude of this capacity to predict final course marks in Education I from the scores on these tests was carefully analyzed, so that the real meaning of this prediction became apparent.

In a study of the correlation coefficients between the Differential Aptitude Tests and the five final course marks an explanation for the somewhat lower correlation in the final study may appear. Take, for example, the courses 150 and 154. Both do not correlate, not even at the 5% level with the scores in the Verbal Reasoning, Abstract Reasoning, and Sentences tests. Course 150, in fact, has not a single correlation coefficient with any section of the Differential Aptitude Tests which is significant at the 5% level. The other three courses 151, 152, and 153 correlate much more consistently with the Verbal Reasoning, Abstract Reasoning, and Sentences tests.

TABLE XVII

COMPARISON OF THE D. A. T. SCORES OF THE TOP SIX STUDENTS OF THE EDUCATION I CLASS WITH THOSE OF THE LOWEST SIX STUDENTS

Student	V.R.	N.A.	A.R.	S.R.	M.R.	C.S.A.	Spell.	Sent.
	Raw Scores of the Top Six Students							
12	40	28	32	67	50	70	94	60
21	39	26	33	45	59	72	96	64
33	41	30	36	45	35	66	93	73
34	38	28	37	38	40	70	90	66
43	49	40	44	50	55	72	100	83
47	47	29	38	46	46	57	96	79
Means	42.33	30.17	36.67	48.50	47.50	67.83	94.83	70.83
Student	V.R.	N.A.	A.R.	S.R.	M.R.	C.S.A.	Spell.	Sent.
	Raw Scores of the Lowest Six Students							
2	45	36	34	73	62	63	61	62
5	19	22	26	29	14	50	72	36
15	33	31	40	21	48	80	92	49
23	36	21	28	12	55	61	66	68
44	32	26	25	20	11	60	84	57
51	41	29	32	15	25	76	90	57
Means	34.33	27.83	31.17	28.17	35.83	65.00	84.17	54.83
	Difference Between the Means of the Two Samples							
	V.R.	N.A.	A.R.	S.R.	M.R.	C.S.A.	Spell.	Sent..
	8.00	2.34	5.50	20.33	11.67	2.83	10.66**	16.00*

**Significant at the 1% level

*Significant at the 5% level

t-Test Analysis of the Difference of Means

In the t-test analysis of the Differential Aptitude Tests' marks of the top six students and the lowest six students a much greater inconsistency appeared. In both the pilot study, and in the mid-term examinations of the Education I students, the t-test revealed a significant difference in the means of the Verbal Reasoning, Abstract Reasoning, and Sentence tests. The final analysis, as revealed in Table XVII, indicated that only the means of the Sentences Test have a difference which is significant at the 5% level. The means of the Spelling Test, on the other hand, showed a difference significant at the 1% level. This represents the only important exception to the findings of this thesis.

On the whole, the findings of the main research are fairly consistent with those of the pilot study and those of the analysis of the mid-term marks. Even though the proof may not be as conclusive it is still apparent that the Verbal Reasoning, Abstract Reasoning, and Sentences tests appear as the only tests of the Differential Aptitude Tests which are significantly related to the average class marks. This was especially borne out by the correlation coefficients as seen in Table XVI.

CHAPTER VIII

CONCLUSIONS

1. In order to illustrate the conclusions which result from this study, it was found profitable to summarize the significant correlation coefficients which had been computed. Table XVIII contains the correlation coefficients of the three Differential Aptitude Tests (Verbal Reasoning, Abstract Reasoning, and Sentences) with the average class marks in the pilot study, the mid-term examinations of the Education I students, and the final examinations of these students. All the correlation coefficients, except one, are significant at the 1% level. The one exception is significant at the 5% level. A definite positive relationship exists between the class marks of the students in Education I and their marks on the Verbal Reasoning, Abstract Reasoning, and Sentences tests.

TABLE XVIII

SUMMARY OF CORRELATION COEFFICIENTS OF V.R., A.R., AND SENT. TESTS WITH AVERAGE CLASS MARKS

	Pilot Study	Mid-Term Ed. I	Final Ed. I
V. R.	.584**	.452**	.385**
A. R.	.525**	.369**	.281*
Sent.	.686**	.401**	.342**

**Significant at the 1% level
*Significant at the 5% level

2. Table XIX summarizes the t-tests of the differences of the means between the top six students and the lowest six students in all three studies. In the pilot study it was possible to reject the Null hypothesis that no difference exists between the means in the three Differential Aptitude Tests. This is also true for the mid-term examinations of the Education I students. However, in the final analysis only the difference of the means of the Sentences Test is significant, and this only at the 5% level. Even though the t-tests are fairly high for all analyses, they fail to show consistent significance. For the Verbal Reasoning Test only one difference is significant at the 5% level, and that in the pilot study. Similarly, only one t-test is significant in the Abstract Reasoning Test, this one being significant at the 1% level in the mid-term examinations of the Education I students. All three t-tests for the Sentences Test are significant, one at the 1% level and two at the 5% level.

3. The correlation analysis of all three studies and the t-tests of all three studies indicate that very little relationship exists between class marks in Education I at the University of Manitoba and the scores on the Numerical Ability, Space Relations, Mechanical Reasoning, Clerical Speed and Accuracy, and Spelling tests of the Differential Aptitude Tests. It thus rejects their use in predicting success or

failure at the Faculty of Education at the University of Manitoba.

TABLE XIX

SUMMARY OF t-TEST ANALYSES OF DIFFERENCE OF THE MEANS OF THE TOP SIX STUDENTS WITH THE LOWEST SIX STUDENTS

	Pilot Study	Mid-Term Ed. I	Final Ed. I
V. R.	2.60*	2.22*	1.95
A. R.	1.97	3.77**	1.96
Sent.	4.44**	2.97*	2.74*

**Significant at the 1% level
*Significant at the 5% level

4. On the same basis, this research indicates a positive relationship between the class marks of the Education I students and their scores in the Verbal Reasoning, Abstract Reasoning, and Sentences tests. This positive and significant relationship may be used to predict success or failure in the first year of Education. These predicted scores would be subject to a certain restriction as will be shown later.

5. From this positive relationship the following prediction equations have been developed. The technique of

development is the same as that used in Chapter V, but now with the final marks of the Education I students.

(a) The regression equation for predicting the average final mark of a student in Education I from the scores of the Sentences (Language Usage II) Test is

$$Y = .159X + 57.90$$

(b) The regression equation for predicting the average final mark of a student in Education I from the scores of the Verbal Reasoning Test is

$$Y = .295X + 56.41$$

(c) The regression equation for predicting the average final mark of a student in Education I from the scores of the Abstract Reasoning Test is

$$Y = .295X + 57.16$$

6. The multiple regression equation for predicting the average final mark was also derived using the scores on the Verbal Reasoning, Abstract Reasoning, and Sentences tests as predicting variables. This equation follows:

$$X_1' = 52.51 + .16X_2 + .12X_3 + .09X_4$$

Here X_1' represents the predicted score; X_2, X_3, and X_4 represent the scores on the Verbal Reasoning, Abstract Reasoning, and Sentences tests, respectively.

This equation was derived in two ways. First, the normal equations were solved to obtain the beta coefficients.

Second, the Doolittle Method was used to arrive at the same result. Both methods have been outlined in Appendix C.

7. With these regression equations it is possible to predict failure in Education I within certain limits. These limitations have increased somewhat from the pilot study to the main study.

In the pilot study R was equal to .74. In the main study it was equal to .42. R refers to the multiple correlation of the three significant Differential Aptitude Tests taken together with the average. Using R and the formula $\sigma_{1.234} = \sigma_1 \sqrt{1 - R^2}$ the standard error of estimate was computed for both studies. For the pilot study this error of estimate was equal to 4.6. For the main study it was equal to 5.8.

For the pilot study this indicates that two-thirds of the predicted scores from the use of the multiple regression equation would fall within 4.6 marks of the true score. Ninety-five per cent of the predicted scores would be within 9.2 marks of the true score.

Similarly, when using the multiple regression equation developed from the Education I study, two-thirds of the predicted scores would fall within 5.8 marks of their final marks. Ninety-five per cent of the predicted marks would be within 11.6 marks of the final true scores.

This indicates that great care must be taken in the interpretation of any predicted mark. If the error of estimate is not recognized and taken into account when the interpretation occurs serious errors might result.

8. That prediction is possible in the field of education by the use of the Differential Aptitude Tests becomes a reality through this study. The success or failure of students can be predicted, even though only with definite limitations. If it is possible to predict partly, it should be possible to refine the instruments used in the measurement of aptitudes so that they would be less interrelated and more specific. With the growing necessity for guiding pupils and students in this era of mass education, it seems essential that efforts be made to refine and purify the prediction variables, and thus hasten the day when measurement of aptitudes becomes more exact and more scientific.

9. It is hoped that the conclusions and the regression equations arising out of this research will be used to isolate those students in Education I who are probable "failures", so that these may be watched and aided in their decisions. It is also hoped that further refinement of the technique of prediction will be carried out, and that these will more accurately reveal the aptitude of Education I students. May this research help to promote scientific evaluation of aptitudes in the field of education.

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APPENDIXES

APPENDIX A

Raw Scores of Special Summer School Class

on

The Differential Aptitude Tests

and

Course Examinations

TABLE I

RAW SCORES ON THE D. A. T. OF THE SPECIAL SUMMER SCHOOL CLASS

Male Students	V.R.	N.A.	A.R.	S.R.	M.R.	C.S.A.	SPELL.	SENT.
1	28	32	35	33	45	74	90	54
2	25	22	34	47	45	51	53	52
3	49	31	47	81	61	65	100	78
4	46	39	38	63	60	77	98	77
5	26	30	20	53	52	67	64	29
6	42	24	30	21	55	72	96	48
7	34	35	43	48	61	70	80	55
8	41	29	44	72	56	82	92	53
9	31	19	26	39	55	49	61	60
10	26	33	4	15	33	84	94	42
11	38	32	40	12	52	90	100	65
12	26	31	40	50	44	82	90	37
13	41	24	32	41	47	71	75	57
14	36	31	36	37	38	80	94	55
15	37	30	37	71	64	78	88	49
16	32	33	29	43	55	68	90	46
17	40	38	30	58	58	82	96	69
18	48	29	35	52	32	66	98	67
19	25	18	20	41	52	75	54	25
20	27	17	21	55	45	61	80	49
21	42	29	32	55	53	62	98	59
22	34	36	24	36	55	62	80	49
23	43	32	36	55	64	68	72	69
24	48	40	43	43	45	77	88	68
25	34	37	35	77	62	66	78	61
Means	35.8	30.0	32.4	47.9	51.4	69.4	84.4	54.9
Female Students								
26	39	33	23	35	35	83	90	82
27	48	40	41	43	37	100	98	87
28	35	36	26	38	22	88	90	72
29	39	33	32	46	42	64	100	56
30	30	5	18	8	11	82	96	54
31	43	36	35	30	43	89	98	60
32	35	23	30	40	31	84	86	61
33	46	38	49	68	53	91	94	74
34	41	30	34	43	41	69	92	79
35	37	20	34	34	38	65	92	59
36	41	28	25	32	28	69	98	66
37	47	31	36	40	33	82	96	80
38	27	28	32	6	28	72	98	78
39	33	27	28	36	38	92	66	58
40	34	25	33	33	41	75	96	73
41	40	21	35	38	30	75	92	76
Means	38.4	29.5	32.1	33.8	34.4	76.2	92.2	87.0
Entire Class Means	36.9	29.4	32.3	45.5	44.7	72.6	87.7	60.0
S. D. 's	7.1	7.1	9.5	17.0	12.0	10.9	12.4	13.5

TABLE II

RAW SCORES ON THE MID-TERM EXAMINATIONS
OF THE SPECIAL SUMMER SCHOOL CLASS

Male Student	A	B	E	F	G	I	J	K	L
1	74	79	79	79	73	54	67	44	74
2	68	58	50	74	60	60	71	46	78
3	74	73	84	78	62	82	66	93	88
4	70	92	76	91	76	69	67	96	82
5	52	38	52	50	41	63	61	38	68
6	70	71	44	72	60	72	69	84	74
7	66	75	56	80	55	76	71	55	61
8	76	74	56	69	61	58	64	79	72
9	64	75	36	81	75	60	69	45	71
10	54	56	28	80	42	61	60	40	68
11	72	85	68	89	67	70	59	87	71
12	58	59	20	50	66	56	73	73	70
13	72	88	68	44	72	80	72	82	76
14	68	73	60	68	62	77	64	87	75
15	70	82	56	50	75	60	64	72	70
16	74	57	36	51	70	54	70	50	64
17	64	70	56	55	66	76	63	78	72
18	60	50	36	75	70	52	69	71	66
19	56	58	60	85	50	59	68	71	72
20	60	38	44	68	41	37	58	54	40
21	62	63	44	88	73	61	76	78	74
22	72	64	52	65	67	67	68	42	58
23	80	94	52	70	75	67	73	64	80
24	82	94	92	84	70	78	85	96	88
25	62	77	50	89	55	56	71	71	76
Means	67.2	70.2	53.4	71.2	62.8	64.0	67.9	67.8	71.4
Female Students									
26	68	87	60	50	70	76	75	87	78
27	72	88	80	58	78	80	74	92	80
28	82	89	96	65	75	76	83	72	68
29	70	54	35	90	71	73	76	58	46
30	53	68	32	60	75	74	73	51	75
31	86	89	88	65	89	60	74	94	76
32	80	74	56	90	59	68	78	60	58
33	76	79	64	76	71	70-	69	77	75
34	72	86	68	86	40	75	70	87	64
35	56	78	50	89	67	62	65	52	70
36	60	76	36	60	58	65	69	86	60
37	62	82	72	70	60	67	70	84	74
38	70	90	60	65	67	68	88	71	72
39	76	91	80	79	59	70	69	56	74
40	74	67	60	88	54	76	67	90	78
41	76	94	88	76	58	77	80	84	70
Means	70.9	80.9	64.1	73.1	65.9	70.9	74.8	75.1	66.1
Entire Class Means	69.1	74.4	57.9	71.9	64.1	66.7	70.0	70.4	71.2
S. D. 's	8.2	14.3	18.4	13.1	10.8	9.5	6.6	17.3	9.6

TABLE III

RAW SCORES ON THE FINAL EXAMINATIONS
OF THE SPECIAL SUMMER SCHOOL CLASS

Male Stud.	M	N	O	P	Q	S	T	U	V	W	X	Y
1					57	66	80	74	68	75	59	69
2					62	53	73	68	58	80	57	65
3	80		70		73	80	79	90	76	95	70	79
4	87		72	78	78			90	78	90	66	80
5					51	60	80	74	68	70	51	57
6					53	50	69	54	61	65	64	61
7	68			62	61	63	74	69	56	70	63	66
8					69	66	70	72	64	78	68	68
9	67				55	78	75	83	70			68
10	52			50	50	68	62	72	62	78	57	62
11					59	68	68	78	70	78	68	71
12					55	62	70	55	63	69	68	62
13	73				73	73	69	80	80	80	64	73
14	65		78		62		73	82	69	80	77	72
15			70	74	69		72	75	73	80	56	69
16					52	64	65	65	60	78	62	62
17					61		78	80	69	75	59	63
18	66				62	65	78	62	61	65	61	61
19	58			66	38	68		70	64	80	66	64
20					52	65	50	60	59	70	67	55
21	55				61	82	85	80	85	82	62	70
22			64	66	56		75	70	75	90	67	64
23		70	74	74	68			80	92	80	64	75
24	86		78		75		83	95	84	90	67	85
25	75		82	70	51		70	73	78	90	58	71
Means	69.3		73.5	67.5	58.5	66.5	71.7	74.1	67.4	78.8	63.4	67.4
Fmle Stud.												
26		86			52	68	76	88	76	90	58	73
27					68	79	72	90	76	88	66	76
28	81				58	87	84	73	86	95	69	79
29	59				35	76	82	60	76	82	63	64
30	50				51	62	70	71	72	65	61	62
31				88	62	76	80	88	89	82	72	79
32					40	64	69	66	55	70	59	66
33			80	64	66		71	72	71	90	64	74
34	64				66	80	79	83	86	85	67	76
35					60	70	73	71	80	74	61	67
36			54		51	71	76	80	83	78	60	66
37					58	72	73	80	81	84	58	72
38	86		50		65		71	75	80	86	51	75
39				68	73	82	76	85	83	82	70	76
40					55	78	71	85	79	74	63	72
41	82				54	80	80	82	90	85	68	79
Means	70.3		61.3	73.3	57.1	74.6	75.2	78.1	78.9	81.9	63.0	72.1
Entire Class Means	69.7		70.1	69.8	58.0	70.4	73.1	76.4	73.3	80.1	63.2	69.3
S.D.'s	12.0		9.9	9.1	10.1	8.4	6.6	10.3	10.2	7.9	5.4	6.8

APPENDIX B

Raw Scores of the Education 1 Class

on

The Differential Aptitude Tests

and

Course Examinations

TABLE IX

RAW SCORES ON THE D. A. T. OF
THE EDUCATION I CLASS

Male Students	V.R.	N.A.	A.R.	S.R.	M.R.	C.S.A.	SPELL.	SENT.
1	31	26	31	30	56	57	43	39
2	45	36	34	73	62	63	81	62
3	36	31	33	46	52	60	91	59
4	33	25	37	42	53	80	80	51
5	19	22	28	28	14	50	72	36
6	27	31	24	24	36	62	78	36
7	31	38	38	56	45	71	86	43
8	46	19	31	74	36	65	76	40
9	16	34	24	25	59	75	43	29
10	22	15	26	42	52	62	94	39
11	41	38	33	67	39	80	94	48
12	40	28	32	67	50	70	94	60
13	35	21	36	60	56	75	88	59
14	34	30	35	64	56	59	65	60
15	33	31	40	21	48	80	92	49
16	45	33	38	55	55	59	79	58
17	43	35	34	65	52	72	88	51
18	44	13	31	46	40	38	71	69
19	29	28	28	48	50	64	84	29
20	42	35	33	38	50	72	78	41
21	39	26	33	45	59	72	96	64
22	28	10	20	35	32	68	70	53
23	36	21	28	12	55	61	86	68
24	22	31	27	14	55	52	55	42
25	11	20	26	39	40	55	73	36
26	35	33	32	15	61	55	90	63
27	23	24	31	21	36	82	74	53
28	38	20	44	68	52	54	80	51
29	32	29	32	38	41	63	81	47
Means	32.9	27.0	31.6	43.4	48.0	64.6	78.7	49.1
Female Students								
30	47	35	37	52	45	88	92	66
31	27	15	21	28	33	59	81	54
32	45	32	40	69	37	81	100	68
33	41	30	36	45	35	86	93	73
34	38	28	37	38	40	70	90	66
35	36	31	38	13	31	66	92	55
36	34	28	31	35	22	63	94	74
37	32	28	39	45	36	78	74	25
38	46	28	46	72	36	76	86	57
39	44	36	44	65	52	80	92	76
40	31	34	33	43	34	59	84	48
41	33	19	32	37	22	79	96	65
42	43	19	43	43	36	79	98	37
43	49	40	44	50	55	72	100	83

TABLE IX -- Continued

Female Students	V.R.	N.A.	A.R.	S.R.	M.R.	C.S.A	SPELL.	SENT.
44	32	26	25	20	11	60	84	57
45	41	27	44	38	45	61	96	51
46	33	30	33	41	30	71	98	59
47	47	29	38	46	46	57	96	79
48	20	20	28	17	30	96	58	42
49	40	28	39	48	37	96	96	78
50	33	28	36	36	29	71	86	56
51	41	29	32	15	25	76	90	57
52	34	24	23	9	16	72	94	64
53	20	29	27	33	14	93	100	54
54	39	32	32	46	38	69	83	62
55	42	20	31	35	19	66	68	63
56	37	28	29	33	28	69	89	58
57	28	22	32	42	30	69	100	50
58	43	30	29	23	26	72	94	78
59	44	28	35	39	41	65	84	85
60	44	36	41	43	40	74	90	67
61	47	34	35	37	42	59	86	78
62	38	29	19	34	26	72	92	62
63	37	25	33	46	42	75	98	73
Means	37.9	28.2	34.2	38.7	33.2	72.3	89.8	62.6
Entire Class Means	35.6	27.7	33.0	40.9	40.0	68.8	84.7	56.4
S. D. 's	8.5	6.4	6.1	16.5	12.6	10.8	12.7	13.9

Key

V.R. = Verbal Reasoning Test
N.A. = Numerical Ability Test
A.R. = Abstract Reasoning Test
S.R. = Space Relations Test
M.R. = Mechanical Reasoning Test
C.S.A. = Clerical Speed and Accuracy Test
Spell. = Spelling Test (Language Usage I)
Sent. = Sentences Test (Language Usage II)

TABLE X

RAW SCORES ON THE MID-TERM EXAMINATIONS
OF THE EDUCATION I STUDENTS

Male Students	A	B	C	D	E	F	G	H	I	J	K
1	50	63	65	74	71	62	65	68	65	74	65
2	63	54	53	66	54	51	57	50		70	55
3	58	70	63	74	69	67	59	58	80	71	68
4	69	54	59	66	68	56	58	54	80	81	68
5	62	62	60	74	70	52	63	50	80	65	64
6	74	62	65	74	66	70	58	66	80	69	68
7	55	45	59	66	62	54	65	75	80	69	63
8	57	54	62	70	57	42	60	50	80	62	59
9	54	64	55	68	51	46	51	47	65	55	55
10	30	51	38	44	30	31	27	26	65	52	38
11	57	55	64	64	78	74	65	55	80	56	68
12	75	71	65	80	78	93	80	76	80	85	79
13	55	60	53	56	57	50	31	51	80	68	56
14	50	61	57	68	63	52	18	44	80	55	56
15	66	41	57	64	67	55	55	61	65	71	62
16	80	71	60	82	66	80	53	66	65	62	69
17	60	50	67	76	75	77	69	69	65	79	69
18	50	62	59	78	56	75	59	64	80	58	66
19	76	68	71	76	70	82	68	72	80	68	73
20	62	54	69	62	56	61	73	71	65	67	66
21	88	67	79	88	69	74	70	86	65	76	75
22	68	75	63	70	58	64	46	63	65	54	64
23	60	60	51	38	40	44	41	46	65	56	48
24	55	68	74	80	54	64	62	68	80	54	66
25	60	46	65	66	63	38	56	63	65	60	59
26	65	60	65	68	70	57	53	70	65	62	64
27	69	52	67	84	70	58	56	62	65	61	65
28	68	75	67	68	62	74	52	68	65	54	66
29	50	50	54	66	63	53	45	61	65	69	59
Means	62.3	58.8	61.6	70.1	62.5	60.5	55.7	60.4	72.0	65.5	63.1
Female Students											
30	62	73	65	80	76	90	67	50	80	82	74
31	55	64	59	66	59	64	50	46	80	68	61
32	76	79	66	80	75	77	65	71	80	77	75
33	70	81	82	76	66	77	73	76	80	73	76
34	87	69	73	86	70	78	84	68	80	84	79
35	60	67	71	76	73	86	64	85	65	83	73
36	44	56	45	64	42	50	62	46	65	69	56
37	80	70	62	68	56	77	51	59	80	71	67
38	75	65	62	78	61	74	57	67	80	71	68
39	58	59	78	78	73	71	50	77	80	69	71

Table X -- Continued

Female Students	A	B	C	D	E	F	G	H	I	J	K
40	50	56	57	58	67	47	55	61	80	70	62
41	70	74	72	80	57	62	73	54	80	85	72
42	74	81	68	72	76	80	71	68	65	84	73
43	81	85	84	90	76	89	81	90	80	88	84
44	74	55	62	64	44	51	50	50	65	22	56
45	39	64	59	70	59	63	44	51	80	71	61
46	63	62	56	80	71	74	52	57	65	69	65
47	72	68	83	82	68	78	65	78	80	72	74
48	69	50	65	72	73	65	41	50	80	58	63
49	84	76	62	90	81	74	72	72	80	86	79
50	84	52	69	72	67	64	62	73	80	73	71
51	32	53	56	72	47	51	55	50		71	48
52	67	76	61	82	78	75	82	62	90	72	75
53	50	68	68	66	53	43	53	51	80	60	60
54	55	74	73	62	58	70	78	62	65	83	69
55	68	60	57	76	52	68	63	67	65	60	65
56	65	74	75	88	72	92	80	59	90	75	69
57	55	63	50	54	58	59	30	41	80	57	55
58	64	73	64	70	63	66	70	64	80	63	65
59	68	75	79	76	79	79	45	65	80	81	73
60	58	64	74	76	76	73	76	74	80	78	73
61	78	73	71	74	68	68	71	76	80	82	75
62	75	80	66	80	64	50	52	62	65	60	63
63	61	73	71	80	76	72	66	62	90	83	74
Means	65.4	67.4	66.6	74.7	65.7	69.8	61.5	63.1	77.0	72.1	68.3
Entire Class Means	63.9	63.4	64.3	72.5	64.2	65.5	58.8	61.8	74.7	68.1	65.9
S. D. 's	12.4	9.9	8.8	9.9	10.4	14.0	13.9	10.7	7.7	13.3	8.5

Key

A = Mathematics
B = English
C = Social Studies
D = Science
E = Educational Psychology and Testing
F = Child Development and Primary Methods
G = History and Philosophy
H = Administration
I = Speech
J = Physical Education

K = Average

TABLE XI

RAW SCORES ON THE FINAL EXAMINATIONS
OF THE EDUCATION I STUDENTS

Male Students	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	Z_1	Z_2
1	55	52	69	72	70	68	56			77	69						
2	55	65	59	66	58	45	61	60		45							
3	70	78	69	62	70	75		64	64					68			
4	65	68	77	65	78	71	69	76			92		50				
5	55	74	52	52	65	60	60	61			78						
6	50	65	66	68	68	72	58			73	76						
7	45	61	59	71	65	74	65			75	75						
8	65	55	62	67	62	51	64	58	72								
9	65	70	56	67	74	67	60			61	67		55				
12	75	78	86	77	80	78		76		91			66				
13	60	59	72	67	55	59	64	70		75							
14	50	62	62	64	70	65				91		70	50				
15	50	70	76	53	60	62	55	63			69						
16	65	71	80	77	75	80	74	71		80			58				
17	60	72	75	82	72	77	73			80	89						
18	60	72	76	59	71	60	77	74				66					
19	60	68	76	63	70	70	69	70					62			59	
20	45	74	70	67	66	65	61			69	82		59				
21	75	74	80	82	80	81	79	83	76								
22	60	73	74	60	60	69	70		66			64					
23	65	69	67	58	60	50	76	70						73			
24	60	74	71	66	75	68		58		72			56				
25	60	70	59	56	60	61	62		58	81			52				
26	55	64	68	66	64	64	52	60	59	74			53				
27	60	74	74	73	70	66	64	60			70		53				
28	60	68	58	62	70	53	62	70				67					
29	50	69	62	67	65	64	67			79	75						
Female Students																	
30	70	73	78	79	75	75		75		79	79		59				
31	50	79	75	55	65	56		60				65			65		
32	70	72	77	74	75	68	72	76						71			76
33	70	69	76	78	78	76	73	80								78	74
34	75	75	80	81	82	91		71		71	87				86		
35	55	79	80	74	82	85	69	71			71						
36	50	61	69	56	65	64	62	62									72
37	65	72	79	62	65	68		68		61	66				80		
38	55	66	78	63	60	58	70	67									67

TABLE XI -- Continued

Female Students	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	Z_1	Z_2
39	60	62	70	72	65	75	62		72	77			64				
40	60	65	83	72	72	66				75				58			76
41	50	61	66	70	65	72	72	78			68						54
42	75	79	78	73	75	71	74	84			66						79
43	75	77	87	84	72	75	71			82	77		50				
44	65	59	66	41	70	50	55									64	
45	55	70	74	58	58	60	53	61			67						
46	65	65	76	78	70	58		64		68					70		
47	75	81	84	77	70	79	79	78		83		58	56				
48	60	69	71	63	76	68	52			80		68			75		
49	70	84	81	79	70	71	64	80			68			76			
50	55	72	78	60	68	70	59				65				80		
51	50	67	59	50	63	63	45	60									61
52	70	74	76	86	75	64		72								76	81
53	60	66	65	54	65	67	61	68			51						
54	65	77	77	63	72	73	74	72									64
55	65	74	78	60	70	79	70	64									60
56	65	68	79	74	74	73	64	60									66
57	55	55	69	57	66	61	50	57		62							61
58	80	78	70	55	66	66	76	78									81
59	65	74	68	80	68	65	78	73			70						79
60	75	80	74	73	75	70	69	68					65				79
61	65	67	74	82	68	75		76						74			80
62	60	66	68	55	69	70	67	66									50
63	60	61	76	61	80	80	75	78						65			80

Key

L = Practice Teaching
M = Speech
N = Health and Adolescent Psychology
O = Educational Psychology
P = Sociology
Q = Administration
R = Social Studies
S = English
T = German
U = Science
V = Physical Education
W = Art
X = Mathematics
Y = Music
Z = Home Economics
Z_1 = Latin
Z_2 = French

TABLE XII

THE FINAL COURSE MARKS OF THE EDUCATION I STUDENTS

Male Students	Courses 150	151	152	153	154	Average
1	67	72	65	55	69	65
2	55	66	60	55	45	57
3	65	62	70	70	75	68
4	68	55	74	65	71	69
5	64	52	65	55	50	57
6	63	68	69	50	72	64
7	66	71	65	45	74	64
8	62	67	63	65	51	62
9	74	67	60	65	67	67
12	80	77	80	75	75	75
13	53	67	64	60	59	61
14	70	64	64	50	65	62
15	60	53	65	50	62	58
16	75	77	74	65	80	74
17	72	82	75	60	77	73
18	71	59	71	60	60	64
19	70	73	77	60	70	70
20	68	67	69	45	66	63
21	80	82	77	75	81	79
22	60	60	69	60	69	64
23	60	58	52	65	50	57
24	75	66	67	80	66	71
25	60	56	64	50	61	58
26	64	66	64	55	64	63
27	70	73	67	60	66	67
28	70	62	67	60	53	62
29	65	67	65	50	64	62
Means	67.0	66.6	67.5	59.4	65.3	65.1
Female Students						
30	71	79	77	70	75	74
31	65	55	67	50	56	58
32	75	74	76	70	68	73
33	78	78	76	70	76	76
34	88	81	80	75	91	83
35	82	74	73	55	85	73
36	65	56	61	50	64	59

TABLE XII -- Continued

Female Students	150	151	152	153	154	Average
37	65	62	73	65	68	67
38	60	63	70	55	58	61
39	65	72	74	60	75	69
40	72	72	67	60	66	67
41	67	70	77	50	72	67
42	75	73	77	75	71	74
43	75	84	82	75	75	78
44	70	41	59	65	50	57
45	58	58	64	55	60	59
46	70	78	68	65	58	68
47	70	77	78	75	79	76
48	76	63	70	60	68	67
49	70	79	70	70	71	73
50	68	60	71	55	70	65
51	63	50	56	50	63	56
52	73	86	76	70	64	74
53	65	64	66	60	67	62
54	74	63	72	65	73	69
55	70	60	68	65	78	68
56	74	74	68	65	73	71
57	66	57	60	55	61	60
58	66	55	73	60	68	68
59	68	60	75	65	63	70
60	75	75	73	75	70	73
61	68	82	76	65	73	73
62	69	55	64	60	70	64
63	80	61	78	60	80	72
Means	70.4	67.6	71.0	63.5	69.4	68.4
Entire Class Means	68.9	67.2	71.0	61.7	67.6	66.9
S. D. 's	6.5	9.7	6.4	8.8	9.0	6.4

Key

150 = Foundations of Education
151 = Educational Psychology
152 = Methods of Teaching School Subjects
153 = Practice of Professional Skills
154 = School Administration

APPENDIX C

The Development of the Regression Equation for the Education I Class

(a) By the use of the normal equations, and

(b) By the use of the Doolittle Method.

Development of the regression equation for the main study.

The Normal Equations to obtain the beta coefficients are:

$$\beta_{12} + .585\beta_{13} + .630\beta_{14} = .385$$
$$.585\beta_{12} + \beta_{13} + .282\beta_{14} = .281$$
$$.630\beta_{12} + .282\beta_{13} + \beta_{14} = .342$$ [1]

M_1	=	66.93	(Mean of average)	σ_1	= 6.44
M_2	=	55.72	(Mean of V. N.)	σ_2	= 8.85
M_3	=	53.11	(Mean of A. N.)	σ_3	= 6.18
M_4	=	56.8	(Mean of Sent.)	σ_4	= 13.89 [2]

$$R = .42$$

The regression equation is:

$$X_1^1 = 52.79 + .157X_2 + .113X_3 + .085X_4$$

---

[1] The correlation coefficients were obtained from Tables VIII and XVI.

[2] The statistics obtained from Tables IX and XII.

The Doolittle Solutions for the Multiple Regression Equation for the Education I Class

	2	3	4	1	
	X_2	X_3	X_4	X_1	Sum
Ar_{2k}	1.000	.585	.630	.385	2.600
B = A ÷ (-A_2)	-1.000	-.585	-.630	-.385	-2.600
Cr_{3k}		1.000	.282	.281	2.148
D = A x B_3		-.342	-.369	-.225	-1.521
E = (C ≠ D)		.658	-.087	.056	.627
F = E ÷ (-E_3)		-1.000	.132	-.085	-.953
Gr_{4k}			1.000	.342	2.254
H			-.397	-.243	-1.638
I			-.011	.007	.083
J			.592	.108	.699
K = J ÷ (-J_4)			-1.000	-.182	-1.191

β_{14} = .182

β_{13} = .085 ≠ .182 (.132) = .109

β_{12} = .385 ≠ .182 (-.630) ≠ .109(-.585) = .207

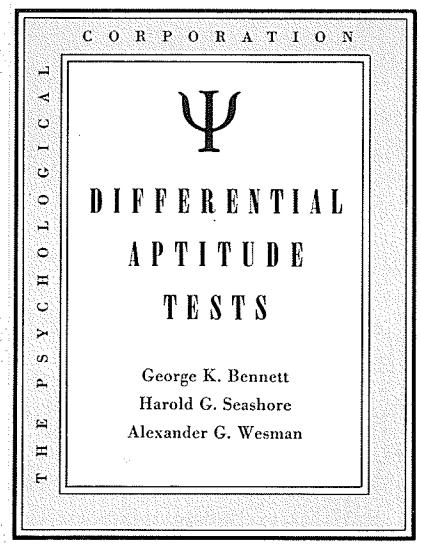
1	2	3	4	5	6	7	8
	β_{1k}	r_{1k}	$\beta_{1k} r_{1k}$	$\frac{\sigma_1}{\sigma_k}$	b_{1k}	M_k	$(-M_k)(b_{1k})$
X_2	.207	.385	.079695	.759	.157	35.59	-5.588
X_3	.109	.281	.030629	1.056	.115	33.00	-3.795
X_4	.182	.342	.062244	.464	.084	56.40	-4.738
		Σ	.172568			Σ =	-14.121
		R =	.415			M_1 =	66.934
						a =	52.813

X_1 = average mark
X_2 = V. R. score
X_3 = A. R. score
X_4 = Sent. score

$$X_1^1 = 52.81 + .157X_2 + .115X_3 + .084X_4$$

APPENDIX D

THE DIFFERENTIAL APTITUDE TESTS



VERBAL REASONING

FORM A

Do not open this booklet until you are told to do so.

On your SEPARATE ANSWER SHEET, print your name, address, and other requested information in the proper spaces.

In the space after **Form**, print an **A**.

Then wait for further instructions.

DO NOT MAKE ANY MARKS IN THIS BOOKLET

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Do not make any marks in this booklet

VERBAL REASONING

Mark your answers on the separate Answer Sheet

DIRECTIONS

Each of the fifty sentences in this test has the first word and the last word left out. You are to pick out words which will fill the blanks so that the sentence will be true and sensible.

For the **first** blank, pick out a numbered word — 1, 2, 3, or 4. For the blank at the **end** of the sentence, pick one of the lettered words — A, B, C, or D. **Combine** the number and the letter you have chosen and mark that combination on the separate Answer Sheet after the number of the question you are working on.

EXAMPLE X. .....is to water as eat is to.....

1. continue	2. drink	3. foot	4. girl
A. drive	B. enemy	C. food	D. industry

Drink is to water as eat is to **food. Drink** is numbered **2,** and **food** is lettered **C,** 2 and C are **combined** as **2C.** The space under 2C has been filled in on line X on the sample Answer Sheet shown below.

Now look at the next example.

EXAMPLE Y. .....is to one as second is to.....

1. middle	2. queen	3. rain	4. first
A. two	B. fire	C. object	D. hill

First is to one as second is to **two. 4A** has been properly marked on line Y on the sample Answer Sheet as the correct answer. 4 is the number for first; A is the letter for two. They were combined to make 4A which was filled in on the sample Answer Sheet.

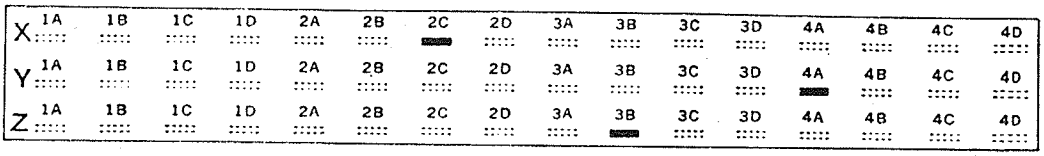
EXAMPLE Z. .....is to night as breakfast is to.....

1. flow	2. gentle	3. supper	4. door
A. include	B. morning	C. enjoy	D. corner

Supper, numbered **3,** is to night as breakfast is to **morning,** lettered **B.** This number and this letter make the combination **3B** which has been found and blackened on line Z on the sample Answer Sheet.

Fill in **only one** space for each question.

SAMPLE OF ANSWER SHEET



DO NOT TURN THE PAGE UNTIL YOU ARE TOLD TO DO SO.

Do not make any marks in this booklet.
Mark your answers on the separate answer sheet.

1. .....is to street as rd. is to.....

1. lo.	2. ma.	3. st.	4. aw.
A. city	B. France	C. end	D. road

2. .....is to cavalry as foot is to.....

1. horse	2. cemetery	3. votary	4. hiding
A. yard	B. travel	C. armory	D. infantry

3. .....is to wide as thin is to.....

1. store	2. narrow	3. nothing	4. street
A. fat	B. weight	C. man	D. present

4. .....is to masculine as woman is to.....

1. disguise	2. malicious	3. virile	4. man
A. intuitive	B. madame	C. feminine	D. girl

5. .....is to dispute as endure is to.....

1. impute	2. repute	3. argue	4. distaff
A. last	B. verdure	C. imbue	D. invert

6. .....is to verse as sculptor is to.....

1. poet	2. reverse	3. free	4. music
A. crime	B. chisel	C. statue	D. artist

7. .....is to chain as bead is to.....

1. watch	2. iron	3. pull	4. link
A. pearl	B. board	C. necklace	D. aim

8. .....is to animal as rind is to.....

1. shell	2. husk	3. skin	4. man
A. hard	B. melon	C. nut	D. corn

9. .....is to cork as box is to.....

1. bottle	2. fish	3. brittle	4. light
A. fight	B. lid	C. hat	D. crate

10. .....is to tusk as deer is to.....

1. ivory	2. work	3. elephant	4. trunk
A. doe	B. hunt	C. moose	D. antler

11. .....is to contralto as tenor is to.....

1. singer	2. soprano	3. sonata	4. solo
A. score	B. song	C. orchestra	D. baritone

12. .....is to hang as guillotine is to.....

1. picture	2. gallows	3. criminal	4. punish
A. revolution	B. behead	C. capitulate	D. citizen

13. .....is to tree as melon is to.....

1. bush	2. elm	3. gnarled	4. apple
A. vine	B. water	C. ripe	D. sweet

GO ON TO THE NEXT PAGE AND KEEP RIGHT ON WORKING.

14. .....is to pea as shell is to.....

1. green	2. sweep	3. pod	4. soup
A. rifle	B. nut	C. crack	D. peel

15. .....is to steer as pork is to.....

1. beef	2. bull	3. cow	4. barn
A. steak	B. lard	C. chop	D. pig

16. .....is to sentence as sentence is to.....

1. jail	2. word	3. period	4. question
A. fine	B. comma	C. paragraph	D. phrase

17. .....is to Dick as Margaret is to.....

1. Richard	2. Francis	3. William	4. Benjamin
A. Mary	B. Peggy	C. Joan	D. Frances

18. .....is to childhood as adolescence is to.....

1. infantry	2. infancy	3. weaning	4. health
A. adultery	B. maturity	C. sinecure	D. intelligence

19. .....is to potato as beater is to.....

1. masher	2. mashed	3. skin	4. spud
A. winner	B. baton	C. steak	D. egg

20. .....is to dog as Guernsey is to.....

1. terrier	2. tail	3. bark	4. cat
A. cow	B. Jersey	C. noble	D. furniture

21. .....is to top as base is to.....

1. ibex	2. spin	3. side	4. apex
A. vile	B. ball	C. bottom	D. home

22. .....is to eagle as Pekinese is to.....

1. flag	2. sparrow	3. dollar	4. vulture
A. Chinese	B. collie	C. yen	D. crow

23. .....is to river as coast is to.....

1. flood	2. boat	3. bank	4. tide
A. beach	B. spa	C. sea	D. sled

24. .....is to foot as elbow is to.....

1. man	2. thigh	3. knee	4. toe
A. hand	B. thumb	C. shoulder	D. finger

25. .....is to day as calendar is to.....

1. noon	2. clock	3. sun	4. night
A. year	B. week end	C. March	D. century

TURN THE PAGE AND KEEP RIGHT ON WORKING.

26. .....is to constitution as prologue is to.....

1. independence	2. law	3. preamble	4. amendment
A. eulogy	B. writ	C. play	D. epilogue

27. .....is to proceed as stop is to.....

1. profit	2. halt	3. recede	4. intercede
A. prevent	B. bottle	C. gone	D. go

28. .....is to horse as bray is to.....

1. drive	2. hoof	3. neigh	4. saddle
A. relay	B. pony	C. wagon	D. donkey

29. .....is to sea as rebellion is to.....

1. mutiny	2. navy	3. sailor	4. river
A. revolting	B. war	C. land	D. soldier

30. .....is to distance as pound is to.....

1. far	2. rod	3. Europe	4. travel
A. heavy	B. ounce	C. weight	D. noise

31. .....is to door as pane is to.....

1. home	2. lock	3. wood	4. panel
A. glass	B. window	C. ache	D. view

32. .....is to never as all is to.....

1. always	2. usually	3. seldom	4. often
A. none	B. whole	C. every	D. total

33. .....is to future as regret is to.....

1. ahead	2. opportunity	3. forecast	4. hope
A. past	B. atone	C. absent	D. sins

34. .....is to rain as levee is to.....

1. cloud	2. fog	3. water	4. umbrella
A. departure	B. flood	C. rise	D. wash

35. .....is to fish as gun is to.....

1. cod	2. bait	3. rod	4. fry
A. hunt	B. trigger	C. shot	D. bullet

36. .....is to pacifist as religion is to.....

1. war	2. atlantis	3. object	4. conscience
A. devout	B. sacred	C. atheist	D. minister

37. .....is to deft as awkward is to.....

1. clumsy	2. hearing	3. blindness	4. newt
A. skillful	B. stupid	C. ugly	D. left

38. .....is to nut as hook is to.....

1. fruit	2. sane	3. bolt	4. hazel
A. bend	B. golf	C. eyehole	D. pitch

GO ON TO THE NEXT PAGE AND KEEP WORKING.

39. .....is to land as knot is to.....

1. desert	2. mile	3. acre	4. farm
A. rope	B. meter	C. sea	D. mountain

40. .....is to bird as shed is to.....

1. call	2. fly	3. migrate	4. moult
A. barn	B. dog	C. hay	D. farm

41. .....is to physician as secretary is to.....

1. hospital	2. doctor	3. nurse	4. medicine
A. office	B. stenographer	C. clerk	D. executive

42. .....is to England as lira is to.....

1. London	2. pound	3. king	4. colony
A. Italy	B. Mexico	C. mandolin	D. money

43. .....is to city as national is to.....

1. mayor	2. Chicago	3. limits	4. municipal
A. country	B. Federal	C. government	D. international

44. .....is to prison as Louvre is to.....

1. warden	2. Bastille	3. crime	4. bars
A. France	B. museum	C. paramour	D. artist

45. .....is to Canada as Havana is to.....

1. Detroit	2. Nome	3. Toronto	4. Alberta
A. Puerto Rico	B. Cuba	C. Mexico	D. Florida

46. .....is to opera as lyric is to.....

1. baritone	2. drama	3. Wagner	4. composer
A. song	B. music	C. poem	D. lilting

47. .....is to bleach as flushed is to.....

1. color	2. gay	3. sheep	4. combine
A. blushed	B. drained	C. wan	D. truffle

48. .....is to static as dynamic is to.....

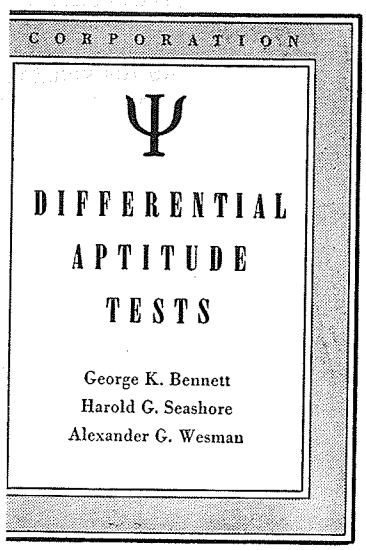
1. radio	2. politic	3. inert	4. air
A. speaker	B. motor	C. active	D. regal

49. .....is to all as part is to.....

1. each	2. right	3. none	4. full
A. whole	B. separate	C. role	D. many

50. .....is to diamond as circle is to.....

1. square	2. shape	3. cube	4. gold
A. triangle	B. oval	C. round	D. smooth



NUMERICAL ABILITY

FORM A

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Mark your answ on the separat Answer Shee

DIRECTIONS

This test consists of forty numerical problems. Next to each problem there are five answers. are to pick out the correct answer and fill in the space under its letter on the separate Answer Sh

EXAMPLE X

Add 13
12

A 14
B 25
C 16
D 59
E **none of these**

In Example X, 25 is the correct answer, so the space under the letter for 25—B—has been filled in.

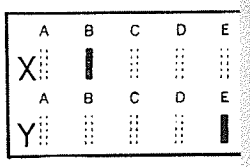
EXAMPLE Y

Subtract 30
20

A 15
B 26
C 16
D 8
E **none of these**

In Example Y, the correct answer has not been given, so the space under the letter for "none of these"—E—has been blackened.

SAMPLE OF ANSWER SH



Each answer must be reduced to its simplest terms. For example, if two choices are $1\frac{1}{2}$ and only the $1\frac{1}{2}$ is correct.

DO ALL YOUR FIGURING IN THE SPACE PROVIDED ON THE ANSWER SHEET.

1. **Add**

393
4658
3790
67

ANSWER

A 7908
B 8608
C 8898
D 8908
E **none of these**

2. **Subtract**

5473
2987

A 2485
B 2486
C 2496
D 3486
E **none of these**

3. **Multiply**

484
25

A 10900
B 11100
C 11900
D 11700
E **none of these**

4. **Multiply**

2.04
.75

A 1.5300
B 153.0
C 1530
D 15300
E **none of these**

5. **Multiply**

4.50
22

A .99
B 98.40
C 99.00
D 9900
E **none of these**

6. **Multiply**

.025
.025

ANSWER

A .001375
B .00625
C .625
D 1.375
E **none of these**

7. **Multiply**

.016
.016

A 256
B 25.6
C .00256
D .000256
E **none of these**

8. **Divide**

$46\overline{)69}$

A $1\frac{13}{46}$
B $1\frac{23}{46}$
C 1.5
D 15
E **none of these**

9. **Divide**

$.75\overline{)2.25}$

A .0003
B .03
C .3
D 3
E **none of these**

10. **Divide**

$3.6\overline{).72}$

A .02
B .2
C 2
D 20
E **none of these**

11. **Divide**

$64.7\overline{)304.09}$

ANSWER

A .47
B 4.07
C 4.7
D 47
E **none of t**

12. **Divide**

$.04\overline{)4.036}$

A 1.009
B 10.9
C 10.09
D 100.9
E **none of t**

13.

$\frac{1}{4} \div \frac{1}{8} =$

A $\frac{1}{32}$
B $\frac{1}{8}$
C $\frac{1}{2}$
D 2
E **none of t**

14.

$\frac{2}{7} \times \frac{3}{7} =$

A $\frac{6}{49}$
B $\frac{3}{7}$
C $\frac{2}{3}$
D $\frac{6}{7}$
E **none of t**

15.

$\frac{3 \times 10}{5 \times 9} =$

A $\frac{27}{50}$
B $1\frac{1}{2}$
C $\frac{30}{45}$
D $\frac{2}{3}$
E **none of t**

Add

$\frac{3}{4}$
$\frac{1}{2}$
$\frac{7}{8}$

ANSWER

A $26\frac{11}{14}$
B $27\frac{1}{8}$
C $28\frac{1}{2}$
D $28\frac{11}{14}$
E none of these

Add

ft. 3 in.
ft. 11 ½ in.
ft. 5 in.
4 ½ in.

A 49 ft.
B 48 ft. 2 in.
C 47 ft. 24 in.
D 48 ft.
E none of these

Add

lbs. 3 oz.
lbs. 7 oz.
lbs. 5 oz.
lbs. 1 oz.

A 28 lbs. 16 oz.
B 28 lbs.
C 27 lbs. 16 oz.
D 18 lbs.
E none of these

Square root

$\sqrt{169}$

A 13
B 43
C 84 ½
D 169
E none of these

Square root

$\sqrt{.09}$

A .03
B .3
C 3
D 9
E none of these

Square root

$\sqrt{\frac{4}{9} \times \frac{25}{36}}$

A $\frac{25}{81}$
B $\frac{25}{36}$
C $\frac{5}{9}$
D $2\frac{7}{9}$
E none of these

$= 33\frac{1}{3}\%$ of 963

A 32.19
B 231
C 321
D 32100
E none of these

$= 12\frac{1}{2}\%$ of 816

A .12
B 12
C 102
D 104
E none of these

$= \frac{4}{9}$ of 648

A 14.58
B 72
C 218
D 1458
E none of these

25. 15 = 75% of ?

ANSWER

A .20
B 10.25
C 20
D 22.5
E none of these

26. 25 = ? % of 125

A $\frac{1}{5}$
B 5
C 20
D 31.25
E none of these

27. 2.5 = ? % of 2

A 5
B 8
C 80
D 125
E none of these

28. $\frac{?}{8} = \frac{3}{24}$

A $\frac{1}{8}$
B 1
C 3
D 4
E none of these

29. $\frac{5}{9} = \frac{55}{?}$

A $\frac{55}{99}$
B 11
C 45
D 99
E none of these

30. $\frac{11}{4} = \frac{77}{?}$

A $\frac{77}{28}$
B 28
C 44
D 308
E none of these

31. **Cube root** $\sqrt[3]{32 \times 2}$

A 4
B 8
C $21\frac{1}{3}$
D 192
E none of these

32. **Cube root** $\sqrt[3]{.000729}$

A .000243
B .009
C .027
D .09
E none of these

33. **Cube root** $\sqrt[3]{\frac{1}{8} \times \frac{125}{64}}$

ANSWER

A $\frac{5}{8}$
B $\frac{375}{512}$
C $2\frac{1}{2}$
D $15\frac{5}{8}$
E none of these

34.

List price = $75.00
Discounts = $33\frac{1}{3}\%$; 2%
Net price = $?

A 25
B 48.50
C 49.50
D 50
E none of these

35. What **one** number can replace **both** question marks?

$\frac{2}{?} = \frac{?}{50}$

A 1
B 10
C 25
D 100
E none of these

36. What **one** number can replace **both** question marks?

$\frac{1}{?} = \frac{?}{36}$

A 6
B 12
C 35
D 36
E none of these

37. What **one** number can replace **both** question marks?

$\frac{4}{?} = \frac{?}{100}$

A 1
B 20
C 25
D 200
E none of these

38. What **one** number can replace **both** question marks?

$\frac{8}{?} = \frac{?}{12\frac{1}{2}}$

A $1\frac{1}{2}$
B 4
C 64
D 100
E none of these

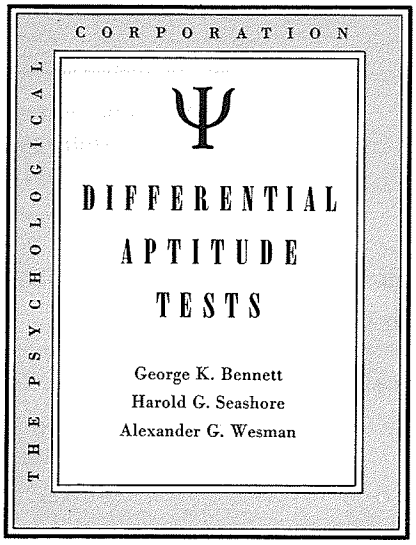
39. What **one** number can replace **both** question marks?

$\frac{6.25}{?} = \frac{?}{16}$

A 4
B 10
C 16
D 50
E none of these

40. $\frac{9+1\times6-3}{4+2\times7-6} =$

A $\frac{57}{50}$
B $1\frac{7}{12}$
C 1
D $\frac{57}{36}$
E none of these



ABSTRACT REASONING

FORM A

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ABSTRACT REASONING

Mark your answers on the separate Answer Sheet

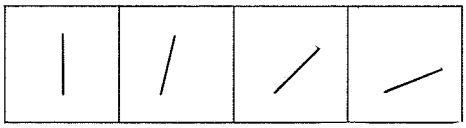
DIRECTIONS

In this test you will see rows of designs or figures like those on this page. Each row is a problem. You are to mark your answers on a separate Answer Sheet as shown in the samples below.

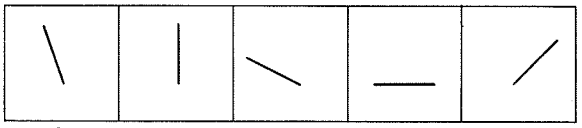
Each row consists of four figures called Problem Figures and five called Answer Figures. The four Problem Figures make a series. You are to find out which one of the Answer Figures would be the next, or the fifth one in the series.

EXAMPLE X

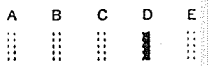
PROBLEM FIGURES



ANSWER FIGURES

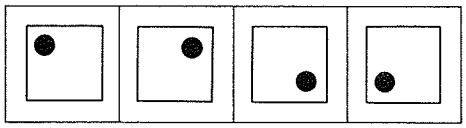


Note that the lines in the Problem Figures are falling down. In the first square the line stands straight up, and as you go from square to square the line falls more and more to the right. In the fifth square the line would be lying flat. So the answer is **D**, which is indicated on your Answer Sheet by filling in the little space below **D**, like this ⟶

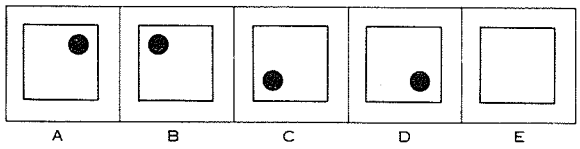


EXAMPLE Y

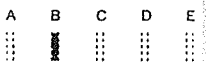
PROBLEM FIGURES



ANSWER FIGURES



Study the position of the black dot. Note that it keeps moving around the square clockwise: upper left corner, upper right corner, lower right corner, lower left corner. In what position will it be seen next? It will come back to the upper left corner. Therefore, **B** is the answer, and you would mark your Answer Sheet like this ⟶



Remember—You are to select the one figure from among the Answer Figures which belongs next in the series.

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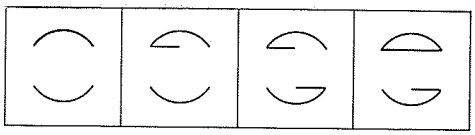
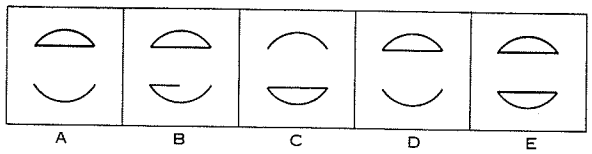
PROBLEM FIGURES

ANSWER FIGURES

1.





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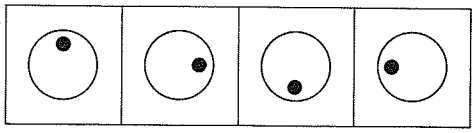

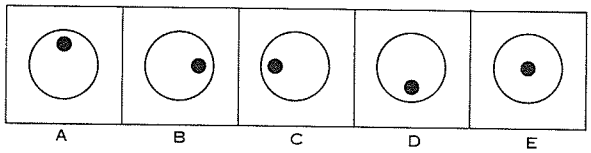

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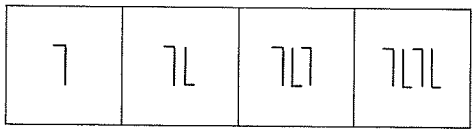

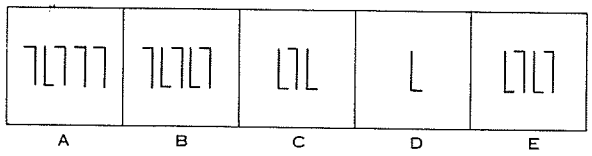

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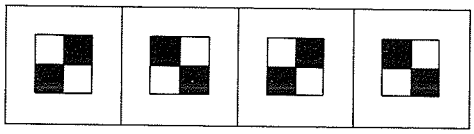

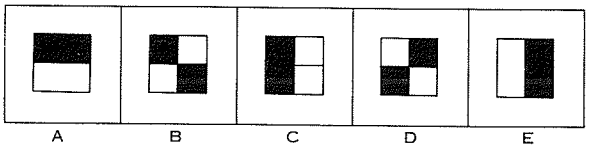

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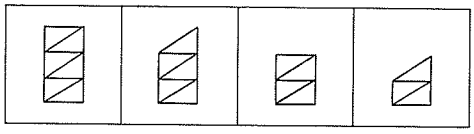

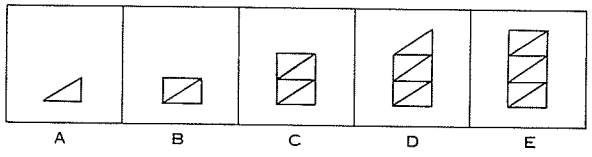

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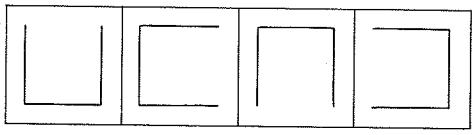

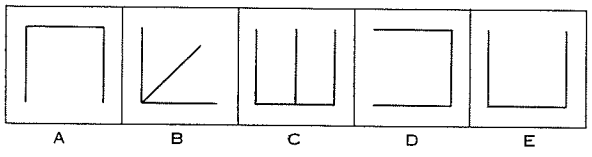

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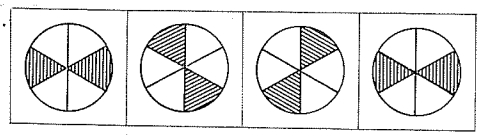

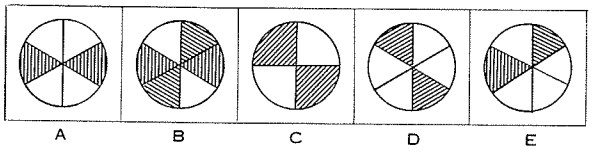

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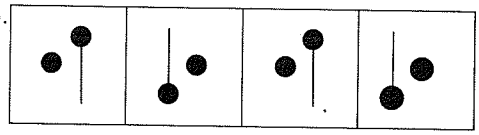

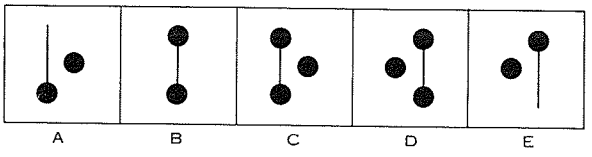

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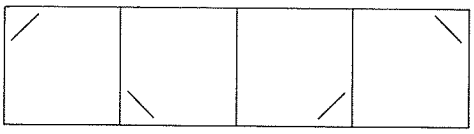

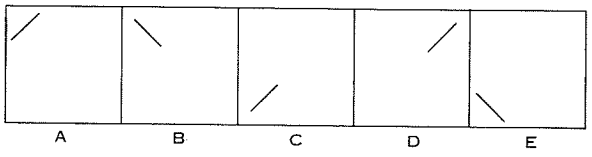

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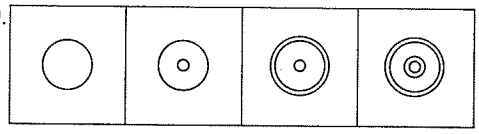

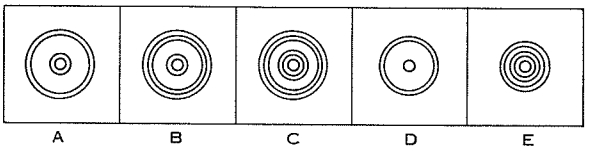

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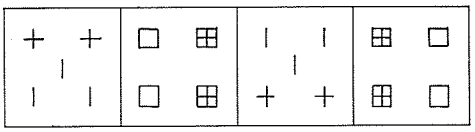

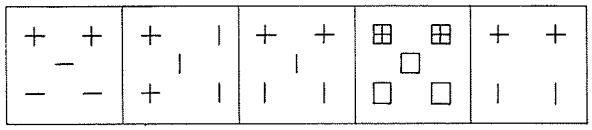

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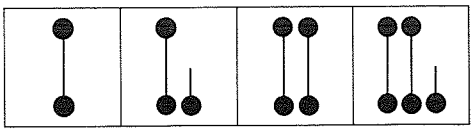

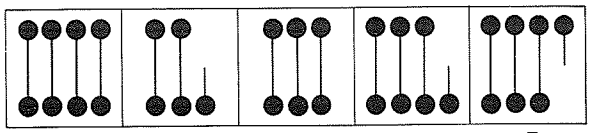

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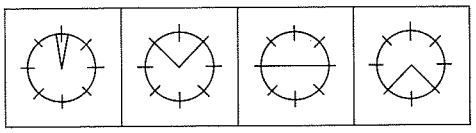

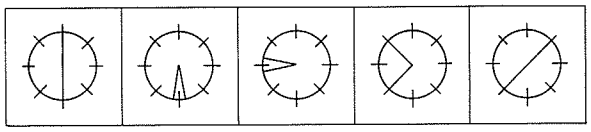

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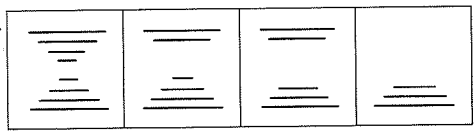

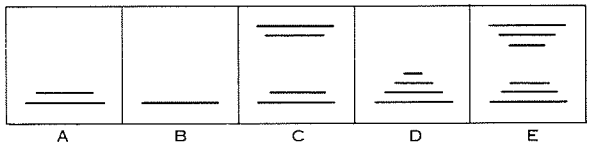

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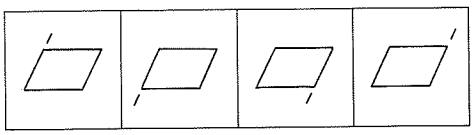

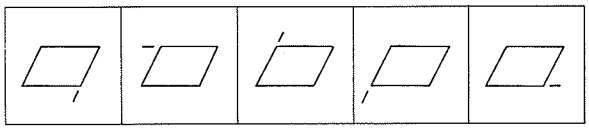

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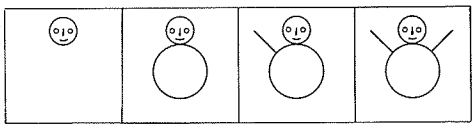

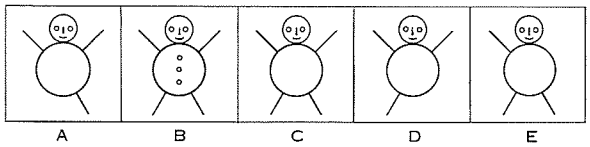

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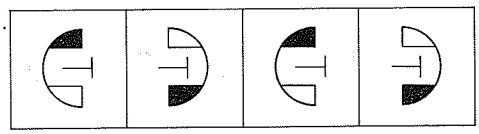

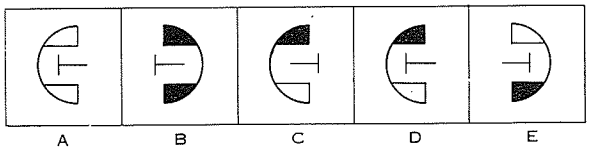

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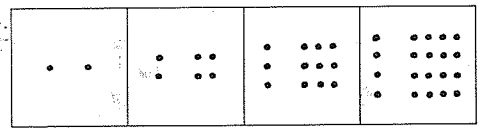

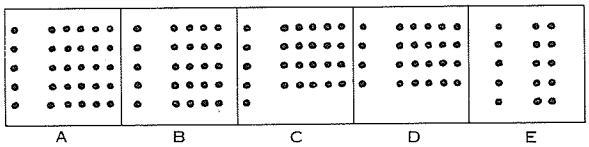

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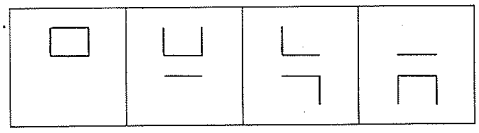

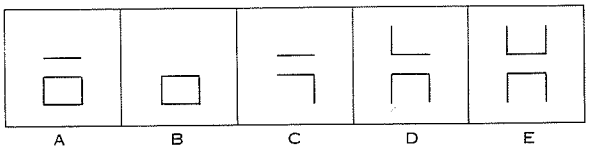

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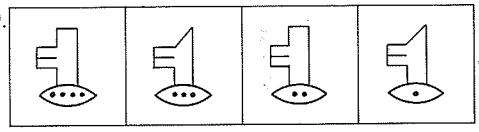
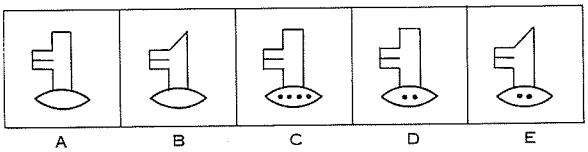
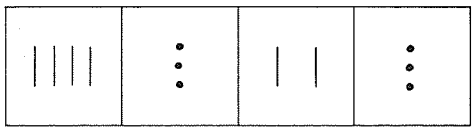
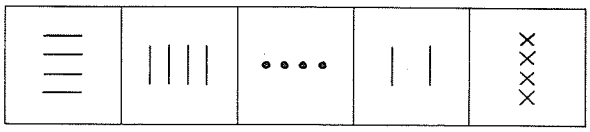


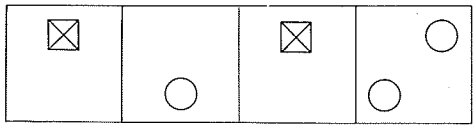


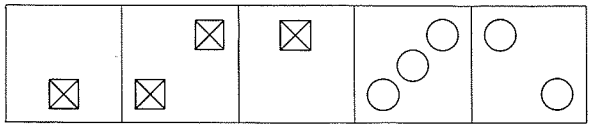
PROBLEM FIGURES

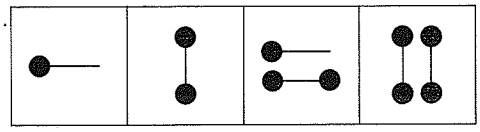
ANSWER FIGURES

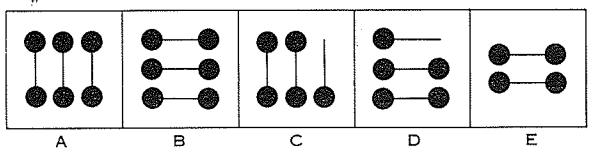
21. 

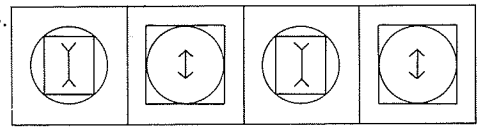


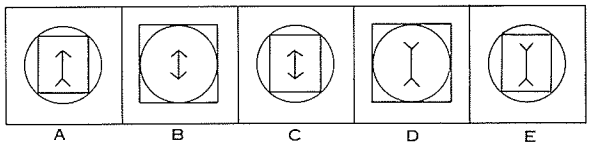
22. 

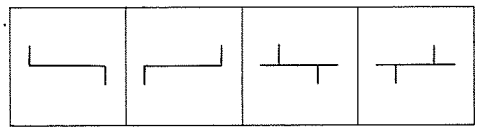


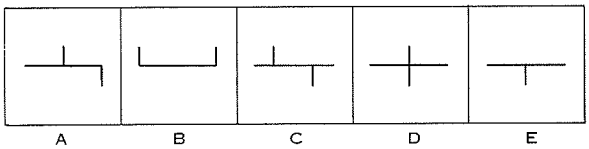
23. 

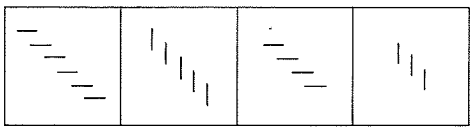


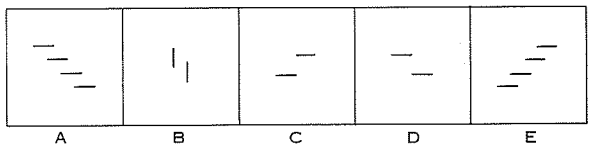
24. 

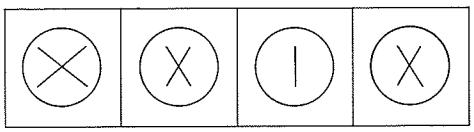


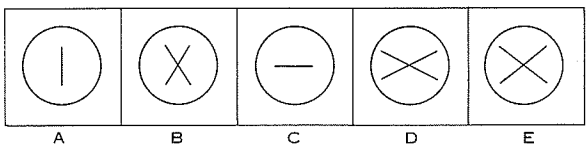
25. 

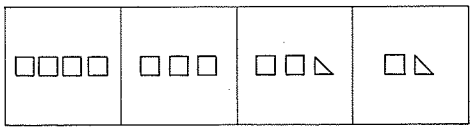


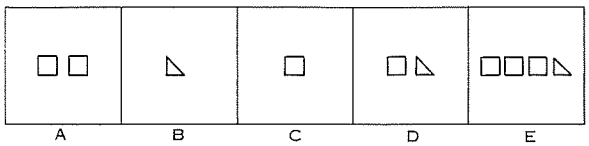
26. 

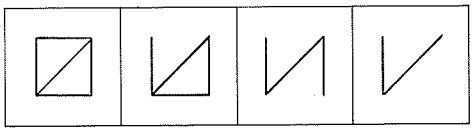


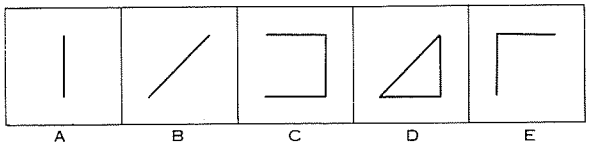
27. 

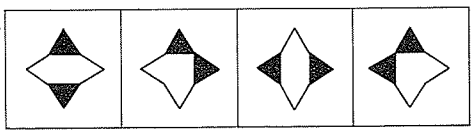


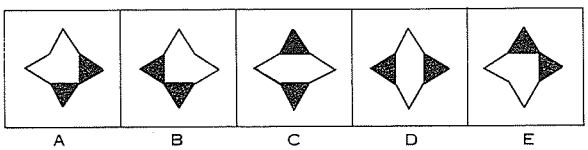
28. 



29. 



30. 



PROBLEM FIGURES

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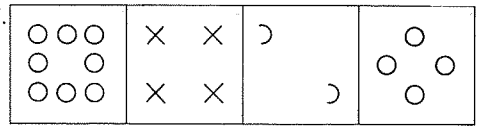

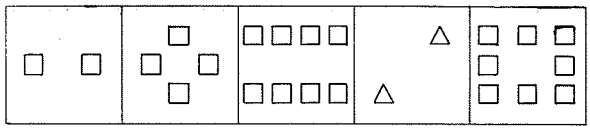

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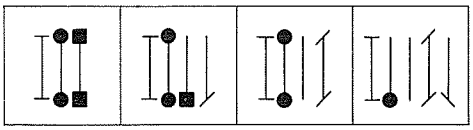

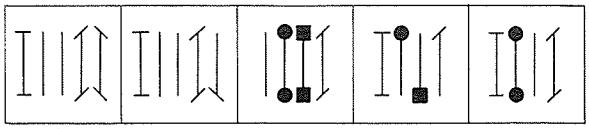

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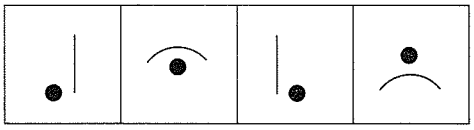

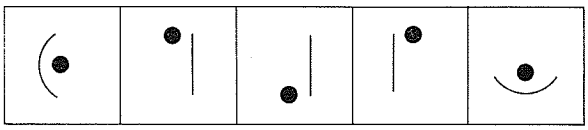

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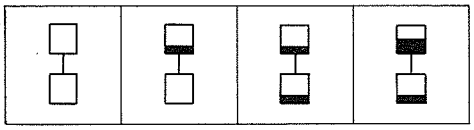

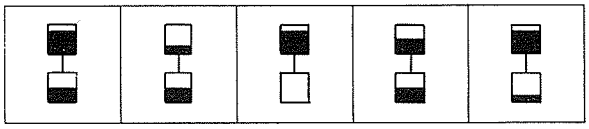

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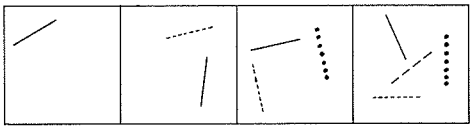

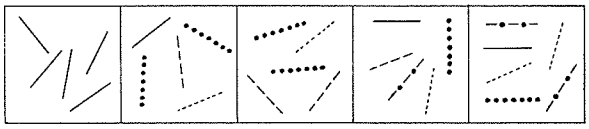

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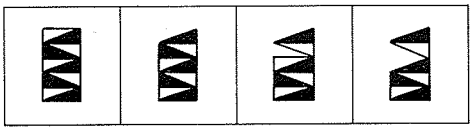

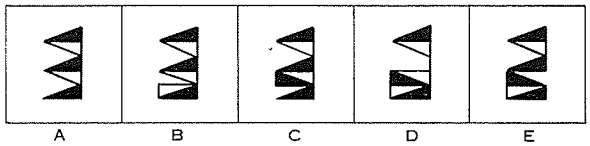

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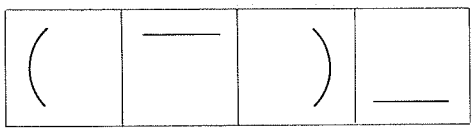

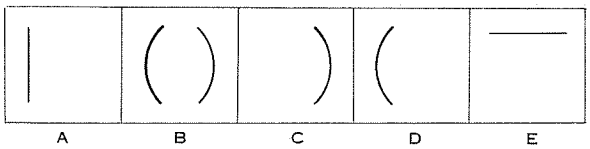

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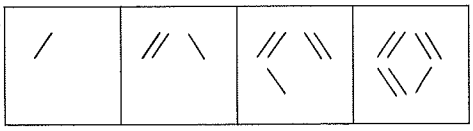

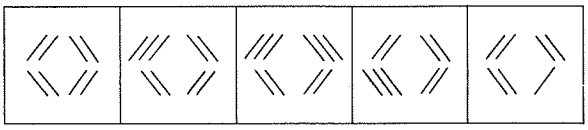

A B C D E

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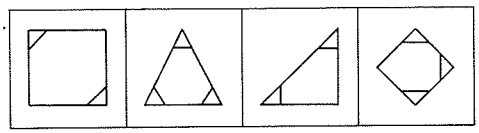

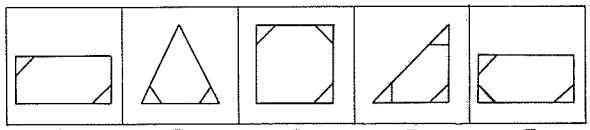

A B C D E

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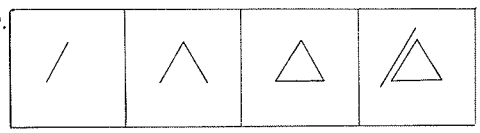

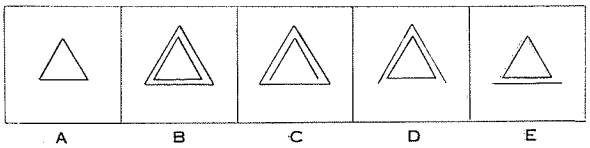

A B C D E

PROBLEM FIGURES

ANSWER FIGURES

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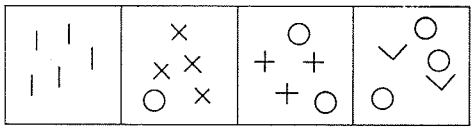

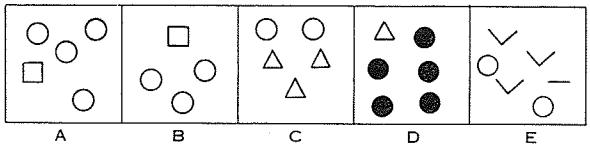

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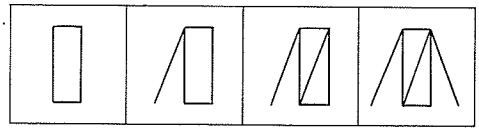

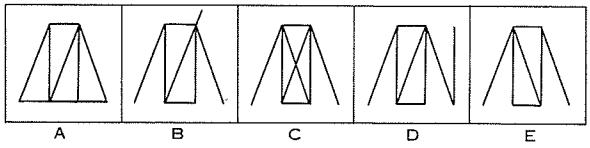

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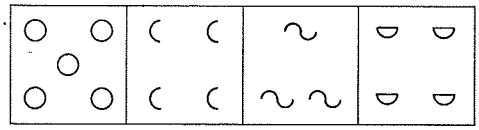

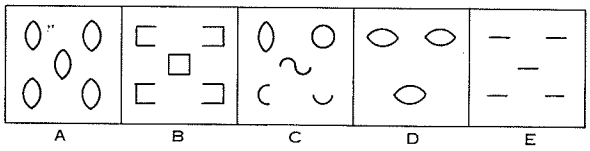

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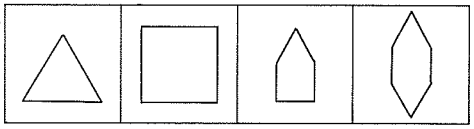

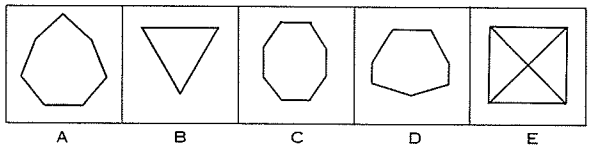

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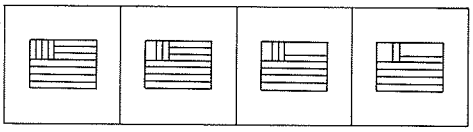

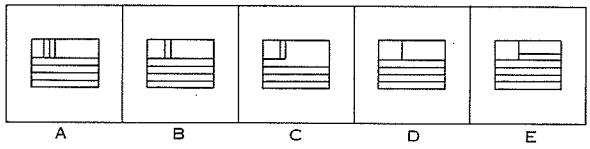

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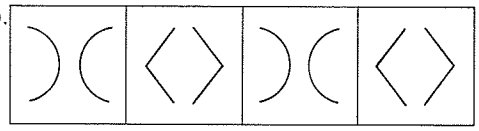

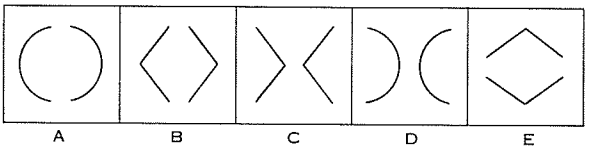

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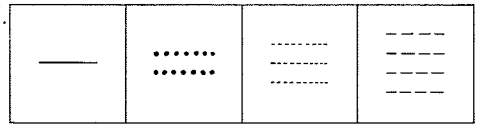

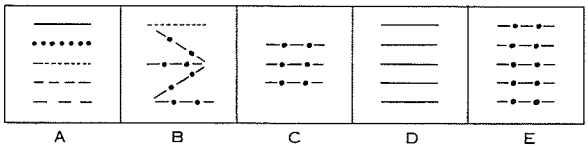

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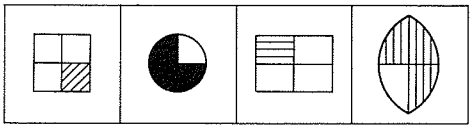

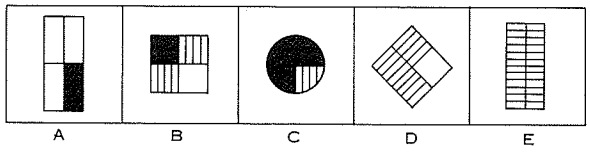

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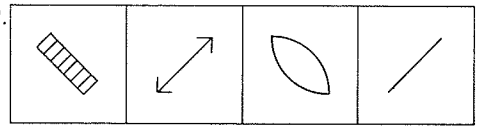

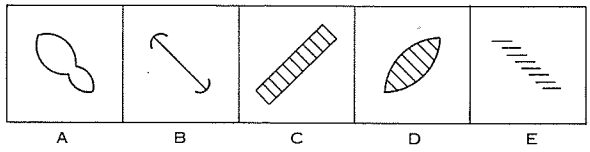

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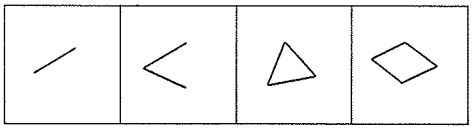

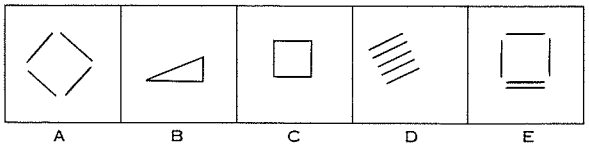

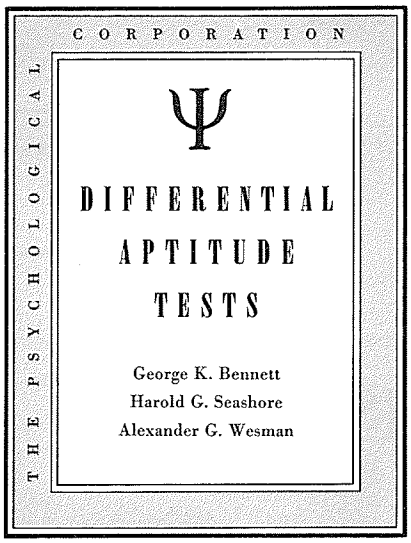

SPACE RELATIONS

FORM A

Do not open this booklet until you are told to do so.

On your SEPARATE ANSWER SHEET, print your name, address, and other requested information in the proper spaces.

In the space after **Form,** print **an A.**

Then wait for further instructions.

DO NOT MAKE ANY MARKS IN THIS BOOKLET

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New York 17, N. Y.

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55-186 TB

Do not make any marks in this booklet

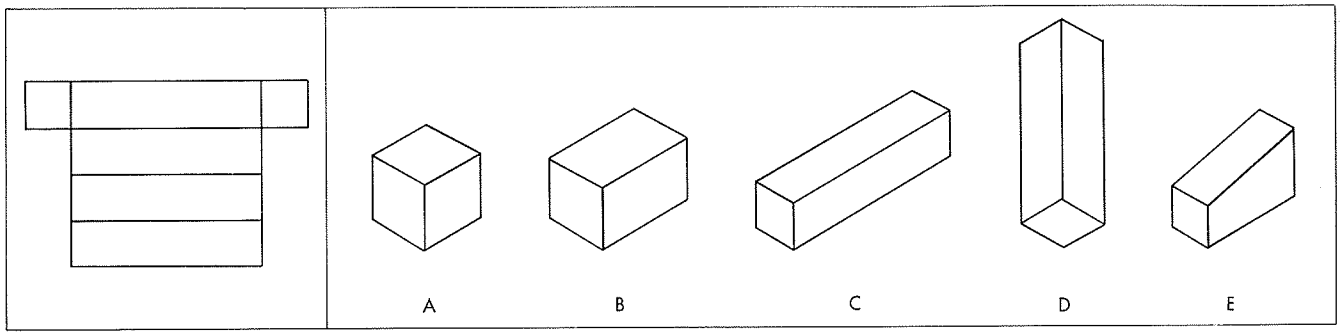
Mark your answers on the separate Answer Sheet

SPACE RELATIONS

DIRECTIONS

This test consists of forty patterns which can be folded into figures. For each pattern, five figures are shown. You are to decide which of these figures can be made from the pattern shown. The pattern always shows the outside of the figure. Here is an example:

EXAMPLE X



Which of these five figures — A, B, C, D, E — can be made from the pattern in Example X? A and B certainly cannot be made; they are not the right shape. C and D **are** correct both in shape and size. You cannot make E from this pattern.

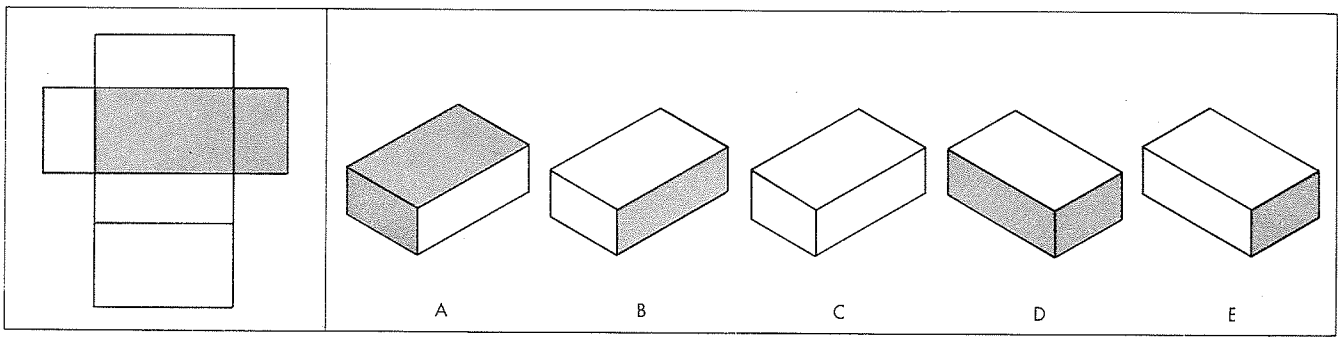
— In the test there will always be a row of five figures for each pattern.

— In every row there is at least one correct figure.

— Usually **more** than one is correct. In fact, in some cases, all five may be correct.

Now look at the pattern for Example Y and the five choices for it. Note that when the pattern is folded, the figure must have two **gray** surfaces. One of these is a large surface which could be **either** the top or bottom of a box. The other is a small surface which would be one end of the box.

EXAMPLE Y



Notice — all the "boxes" made from this pattern are correct in **shape,** but the sides which you see are different. Some of these figures can be made from this pattern while others cannot. Let us look at them.

— Figure A is correct. If the large gray surface is shown as the top, then the end surface of gray can be shown facing towards you.

— Figure B is wrong. The **long, narrow** side is not gray in the pattern.

— Figure C is correct. The two gray surfaces can both be hidden by placing the large gray surface at the bottom and the gray end to the back.

— Figure D is wrong. The gray end is all right, but there is no long gray side in the pattern.

— Figure E is correct. One can show the box so that the large gray surface is at the bottom (as it was in C), but with the gray end showing at the front.

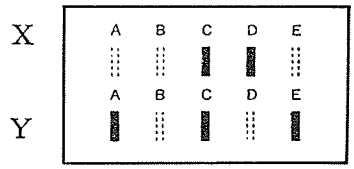
So, you see, there are three figures (A, C and E) which can be made from the pattern in Example Y, and two figures (B and D) which cannot be made from this pattern.

Remember that the surface you see in the pattern must always be the OUTSIDE surface of the completed figure.

Now let's see how we mark our answers on the separate Answer Sheet. A sample is shown here.

For Example X we found that only figures C and D could be made, so the spaces under C and D opposite X have been blackened. For Example Y, A is a correct figure, C is correct, and E is correct, so opposite Y we have blackened in the spaces under A, C and E.

SAMPLE OF ANSWER SHEET



In taking the test:

— Study each pattern.

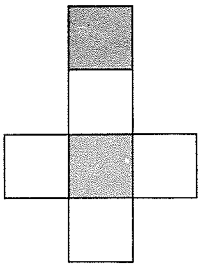
— Decide which of the figures can be made from the pattern.

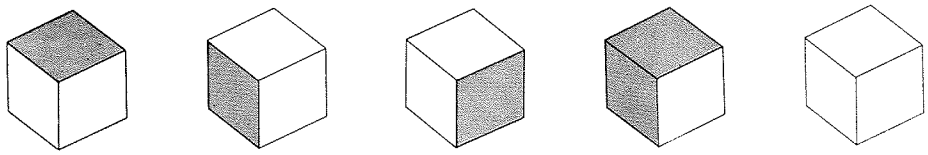
— Show your choices on the Answer Sheet by blackening in the little space under the letter which is the same as that of the figure you have chosen in the booklet.

— If you decide a certain figure cannot be made from the Pattern, make no mark on the Answer Sheet.

Do Not Write Anything in This Booklet
Use Separate Answer Sheet
You Will Be Told When to Begin

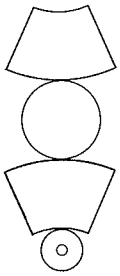
1

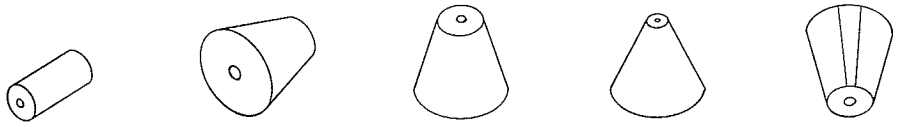




A B C D E

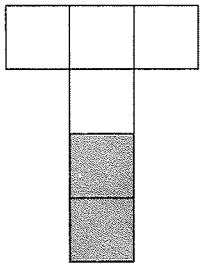
2

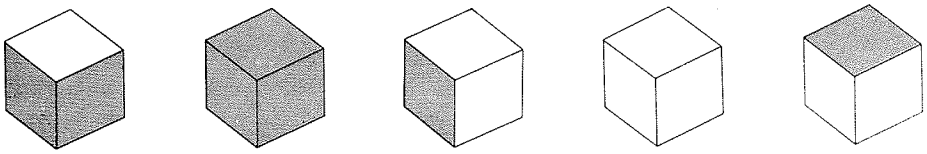




A B C D E

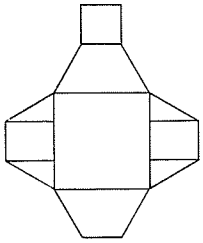
3

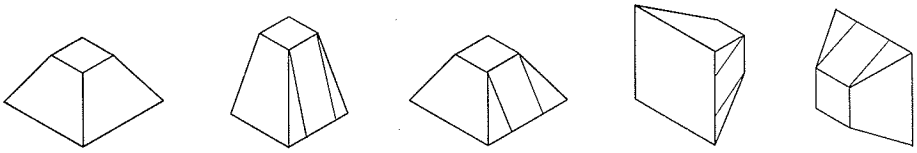




A B C D E

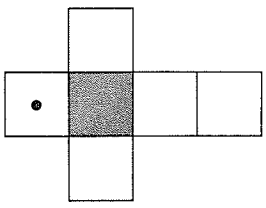
4

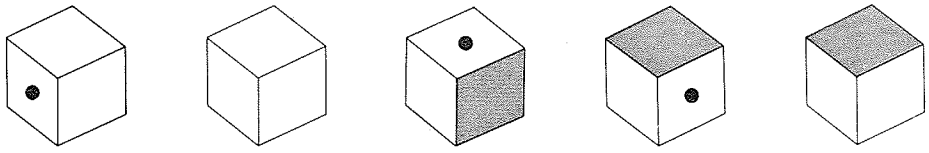




A B C D E

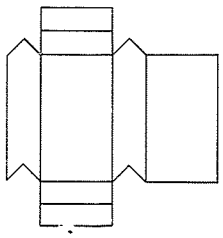
5

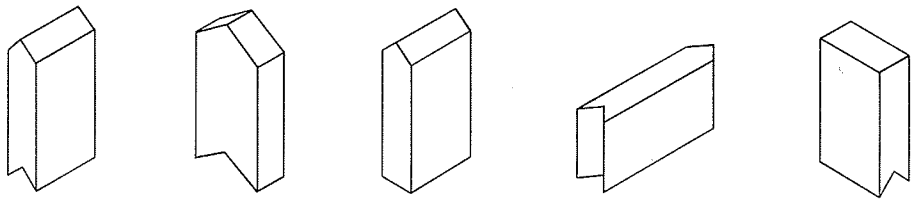




A B C D E

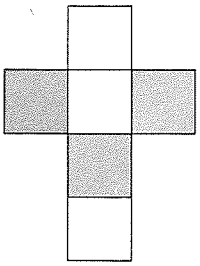
6

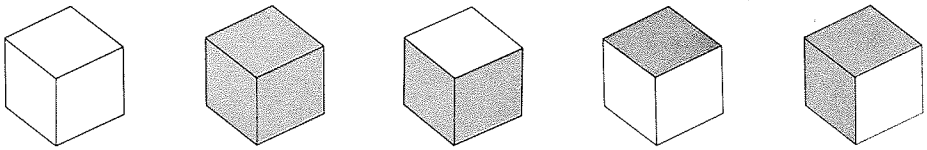




A B C D E

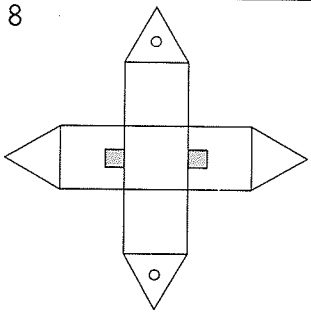
7

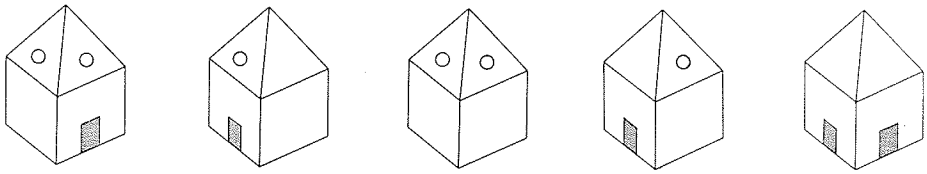




A B C D E

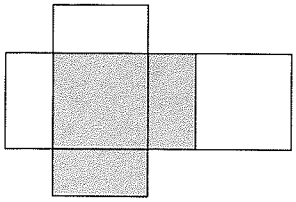
8

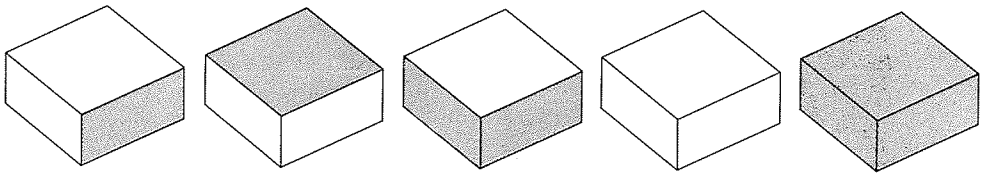




A B C D E

9





A B C D E

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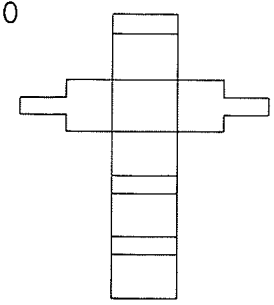
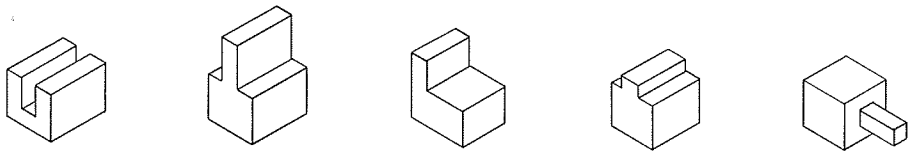
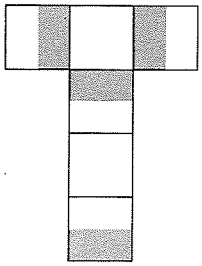
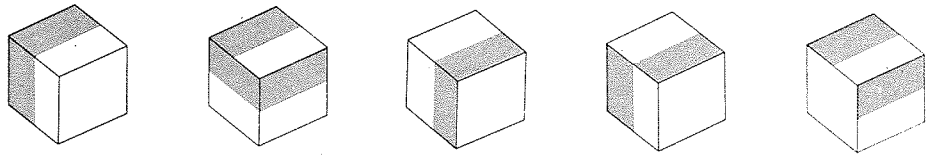




A B C D E

11





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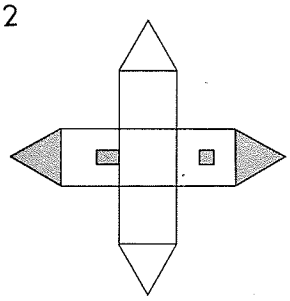

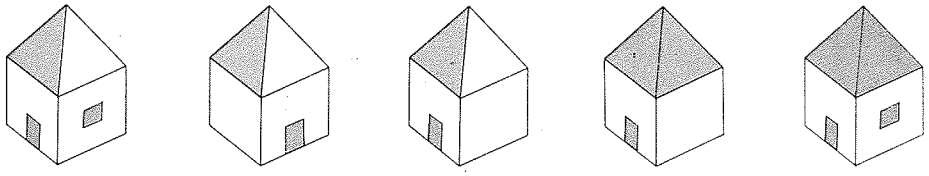

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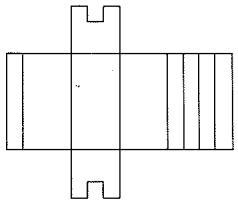

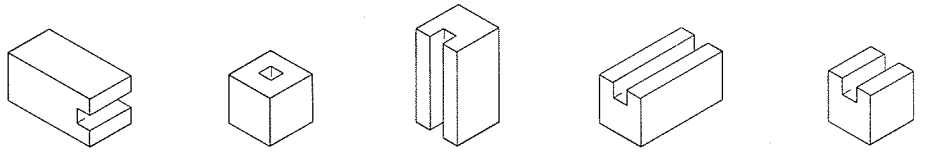

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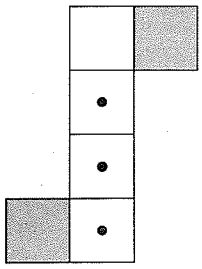

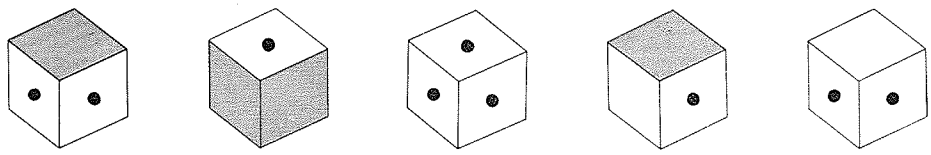

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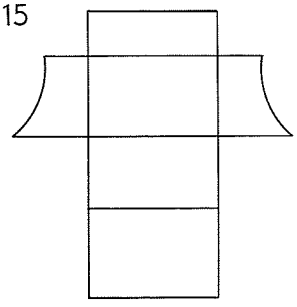

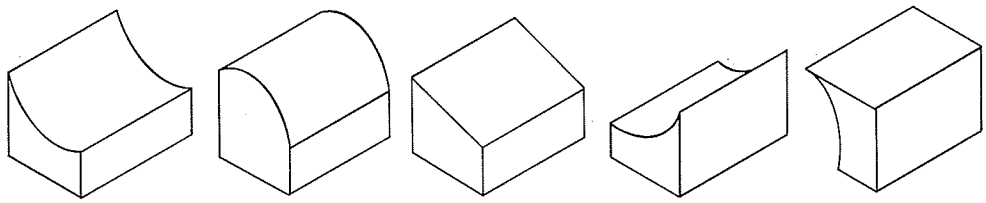

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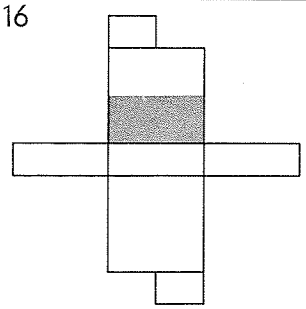

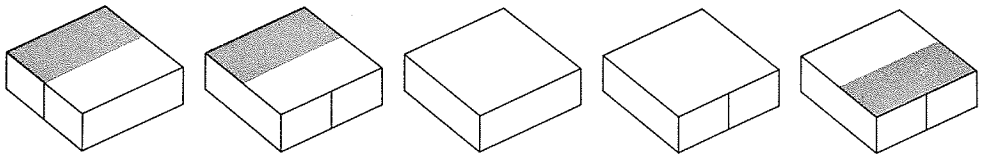

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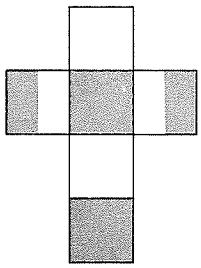

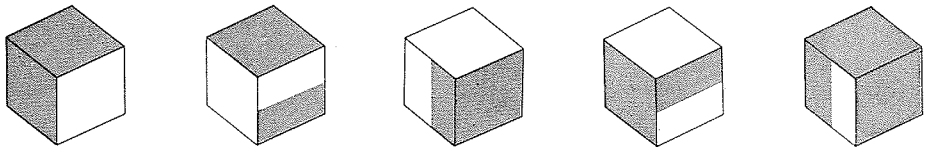

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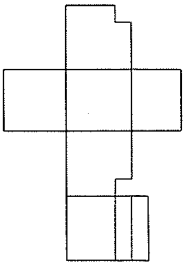

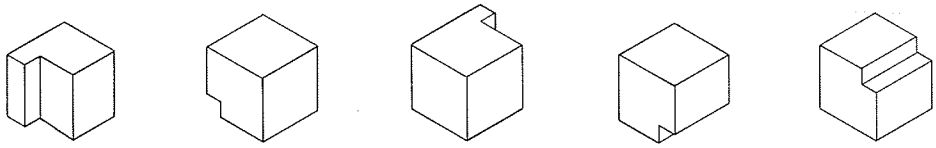

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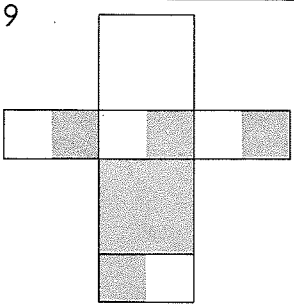

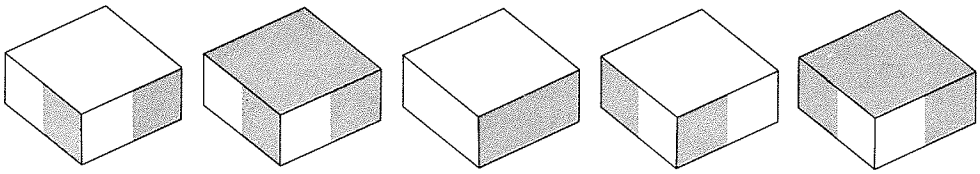

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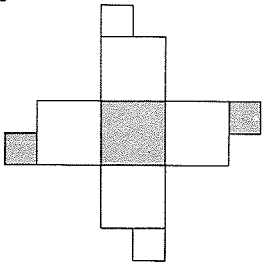

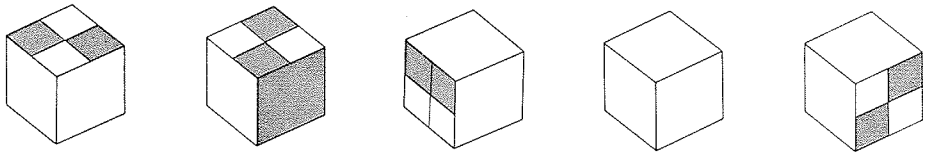

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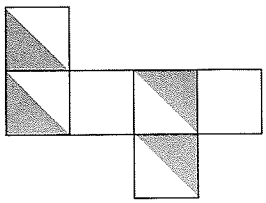

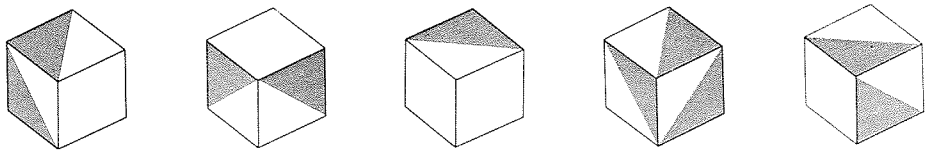

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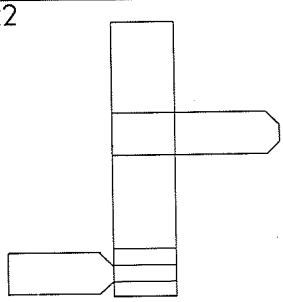

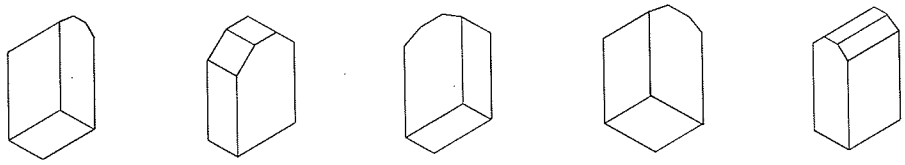

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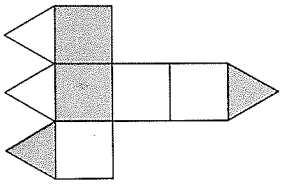

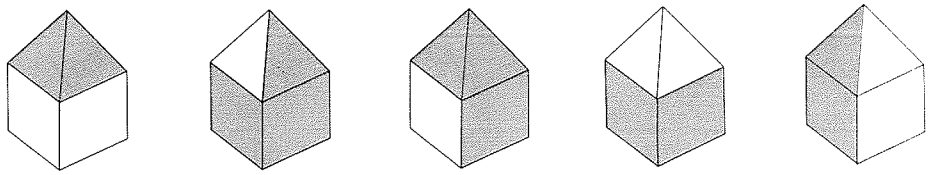

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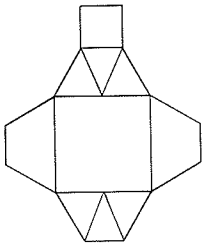

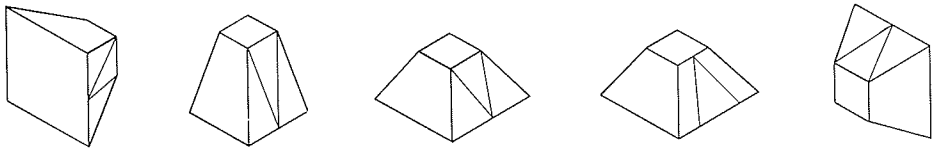

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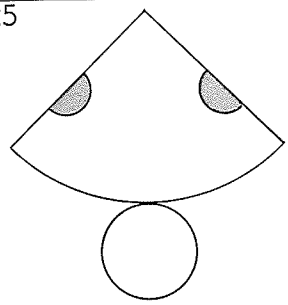

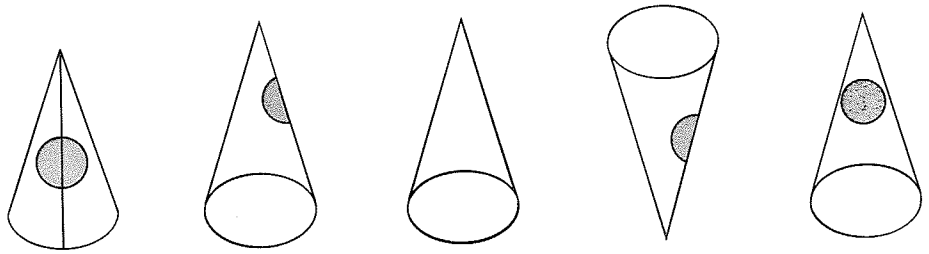

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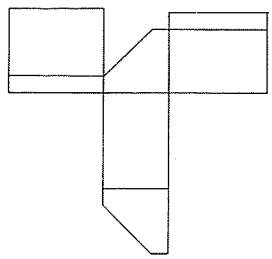

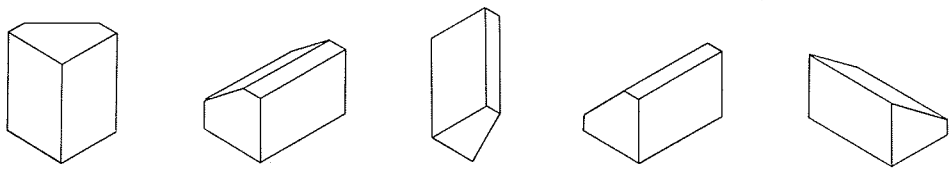

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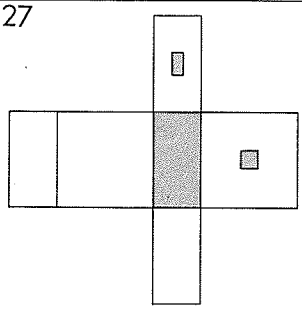

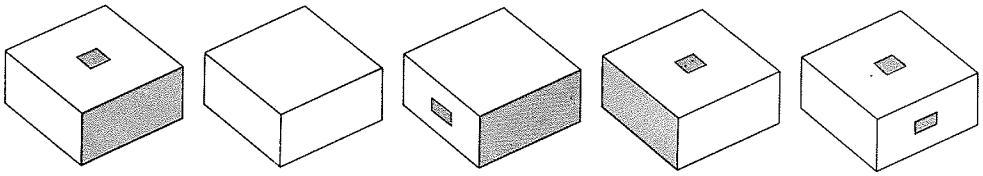

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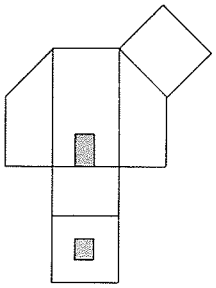

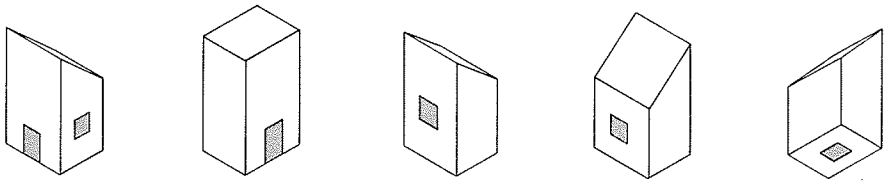

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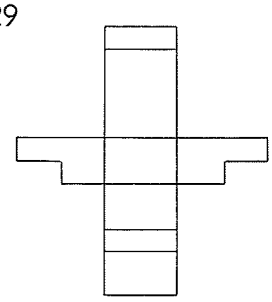

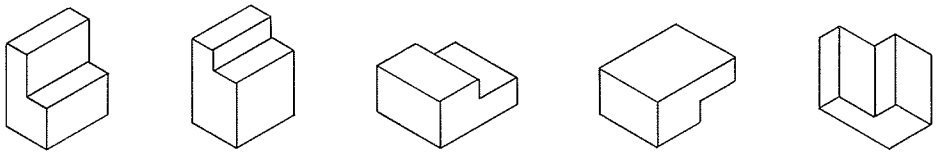

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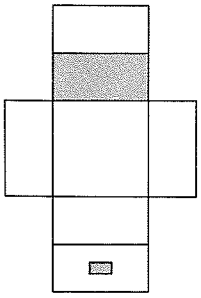

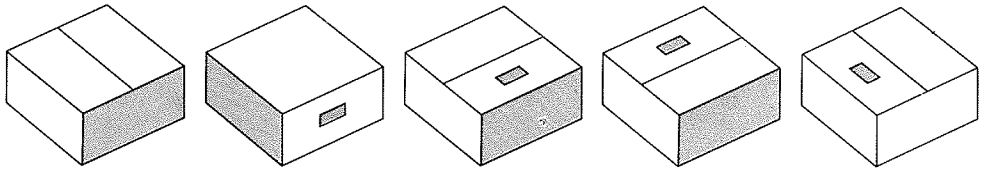

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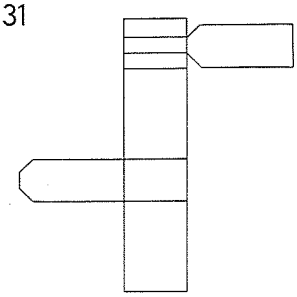

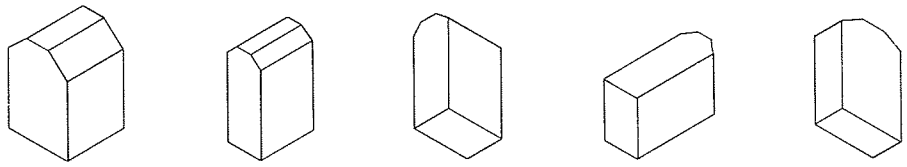

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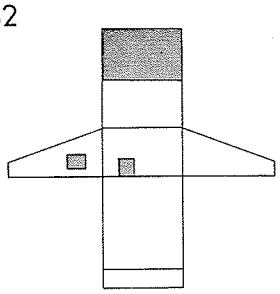

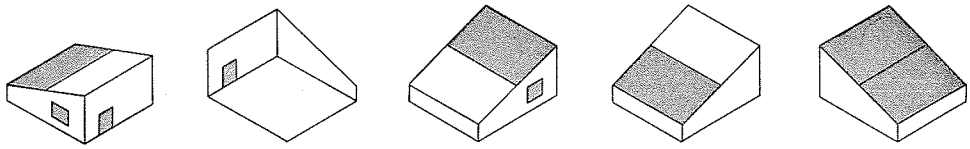

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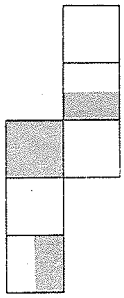

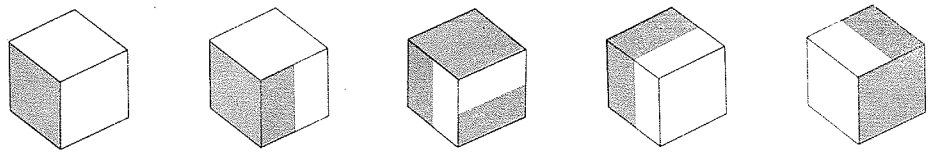

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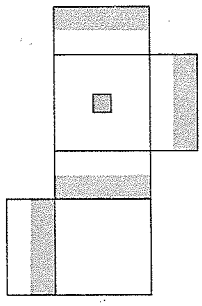

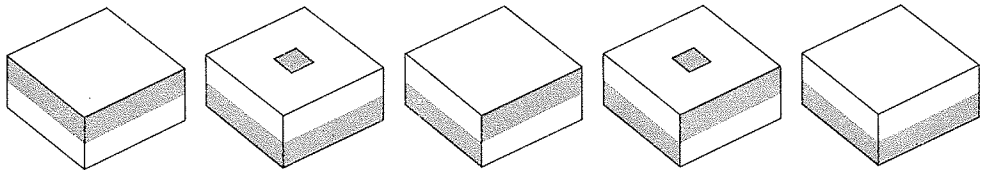

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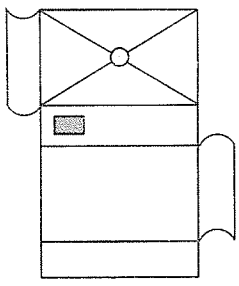

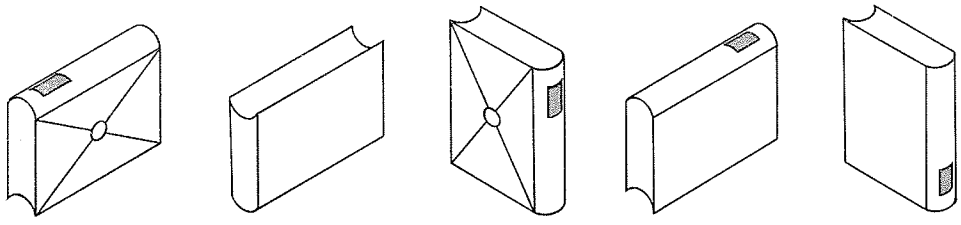

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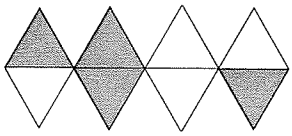

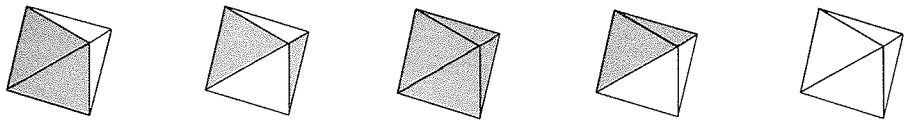

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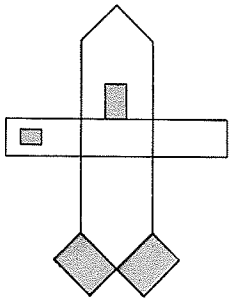

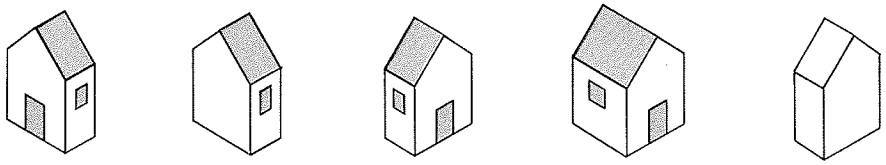

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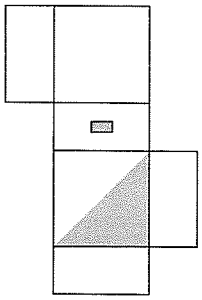
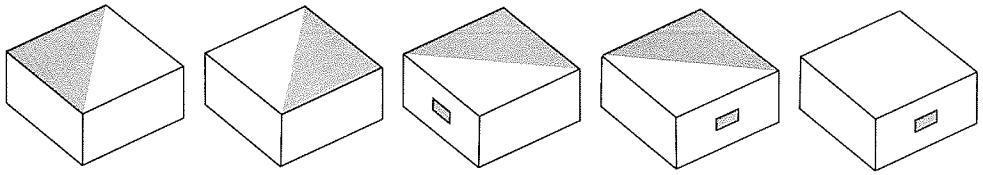
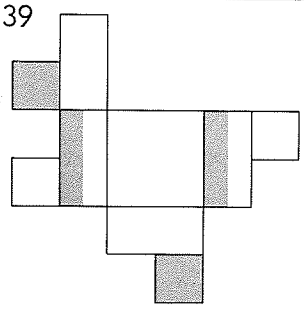
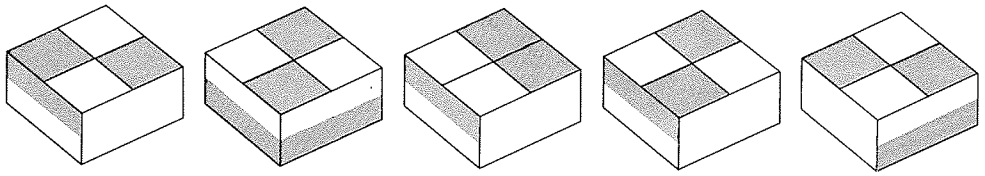




A B C D E

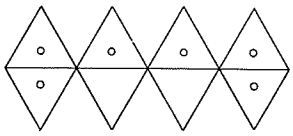
39

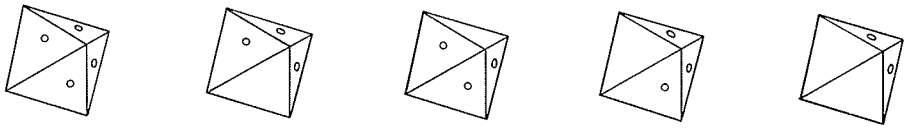




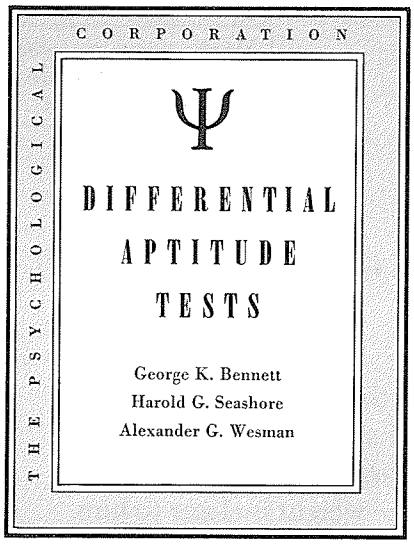
A B C D E

40





A B C D E



MECHANICAL REASONING

FORM A

Do not open this booklet until you are told to do so.

On your SEPARATE ANSWER SHEET, print your name, address, and other requested information in the proper spaces.

In the space after **Form,** print **an A.**

Then wait for further instructions.

DO NOT MAKE ANY MARKS IN THIS BOOKLET

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55-185 TB

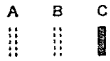
Do not make any marks in this booklet

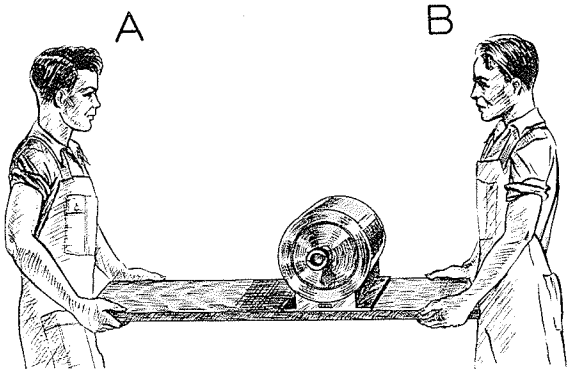
Mark your answers on the separate Answer Sheet

MECHANICAL REASONING

DIRECTIONS

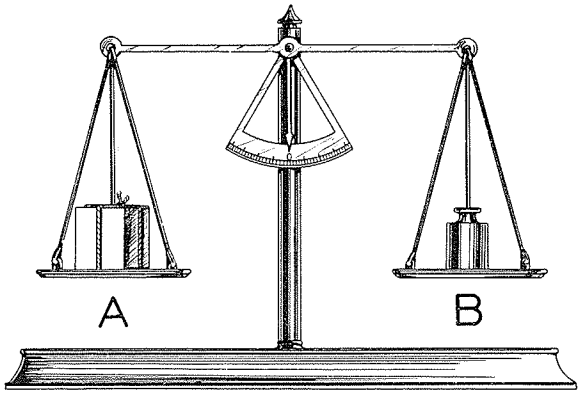
This test consists of a number of pictures and questions about those pictures. Look at Example X on this page to see just what to do. Example X shows a picture of two men carrying a machine part on a board and asks, "Which man has the heavier load? If equal, mark C." Man "B" has the heavier load because the weight is closer to him than to man "A," so on the separate Answer Sheet you would fill in the space under B, like this →

Now look at Example Y. The question asks, "Which weighs more? If equal, mark C." As the scale is perfectly balanced, "A" and "B" must weigh the same, so you would blacken the space under C on your separate Answer Sheet, like this → 



X

Which man has the heavier load?
(If equal, mark C.)



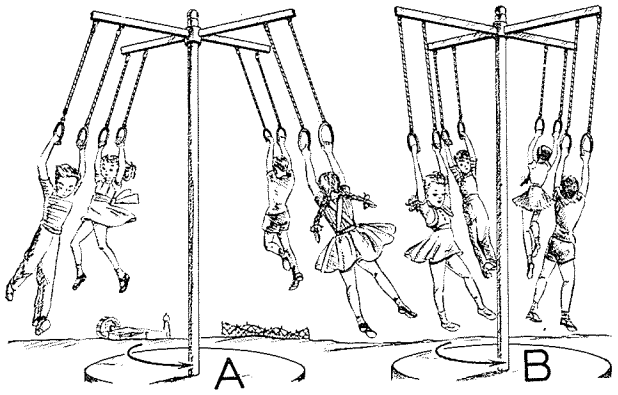
Y

Which weighs more?
(If equal, mark C.)

On the following pages there are more pictures and questions. Read each question carefully, look at the picture, and mark your answer on the separate Answer Sheet. Do not forget that there is a third choice for every question.

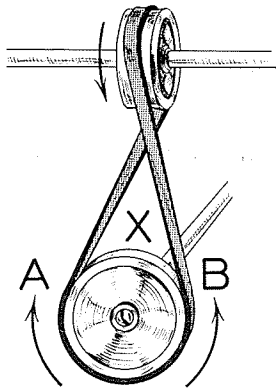
DO NOT TURN OVER THE BOOKLET UNTIL YOU ARE TOLD TO DO SO.

Drawings by Helen Gabryel



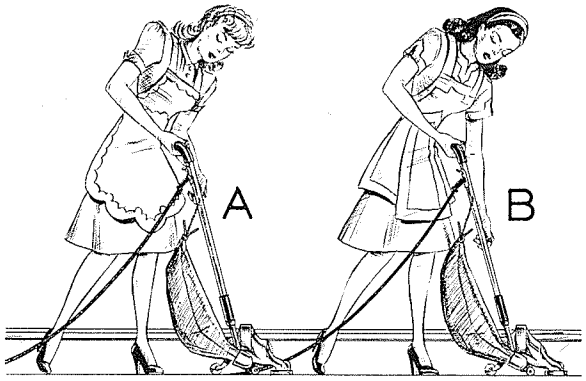
1

In which picture are the children whirling faster?
(If equal, mark C.)



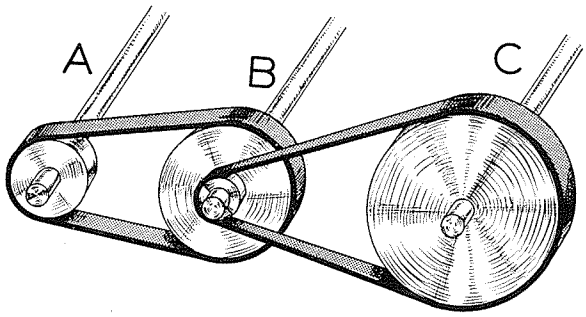
2

When the top pulley turns in the direction shown, which way will the lower pulley turn?
(If either, mark C.)



3

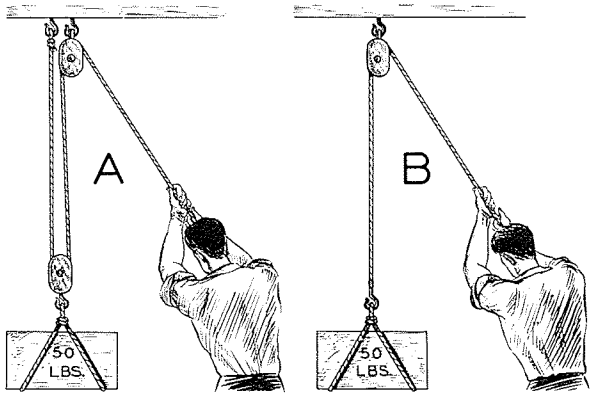
Which girl can lift the cleaner more easily?
(If equal, mark C.)



4

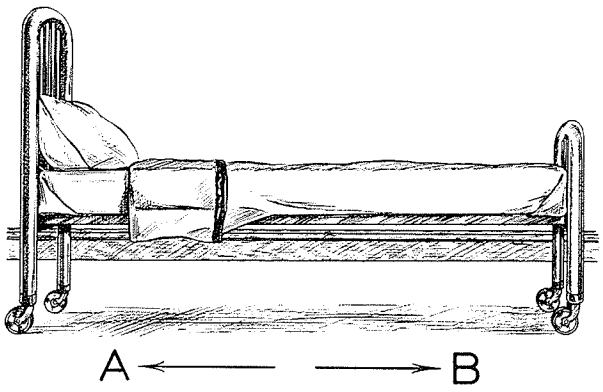
Which shaft will turn most slowly?

PUT YOUR ANSWERS ON THE ANSWER SHEET.



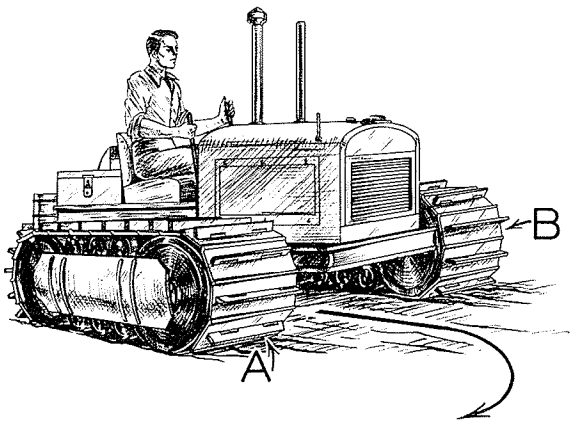
5

Which man must pull harder to lift the weight?
(If equal, mark C.)



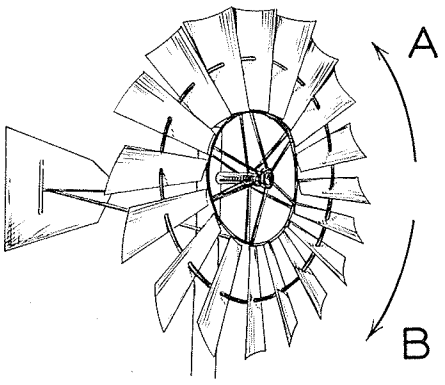
6

Which way has this bed just been rolled?
(If either, mark C.)



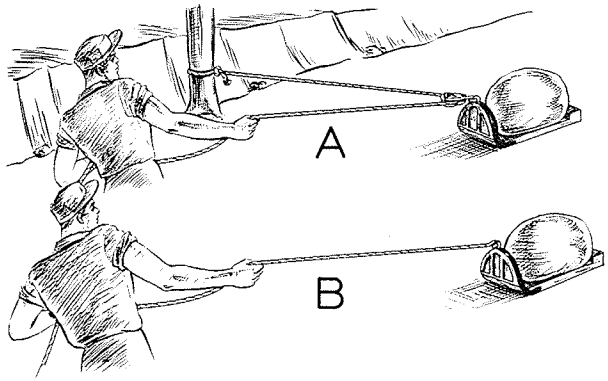
7

Which tread must stop for the tractor to turn in the direction shown?
(If neither, mark C.)



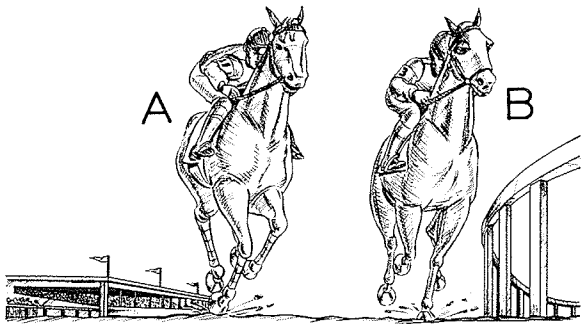
8

In which direction is this windmill more likely to turn?
(If either, mark C.)



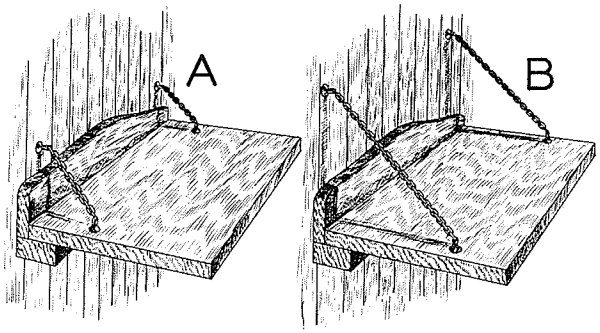
9

Which man has to pull harder?
(If equal, mark C.)



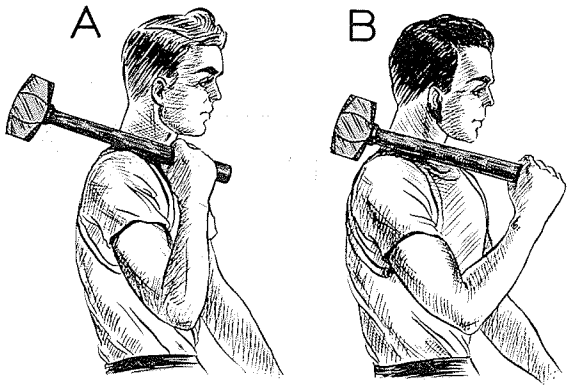
10

Which horse must go faster to hold his place on the turn?
(If equal, mark C.)



11

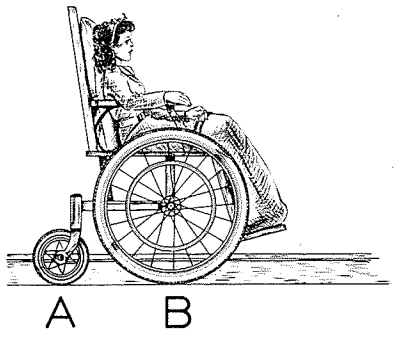
Which shelf is stronger?
(If equal, mark C.)



12

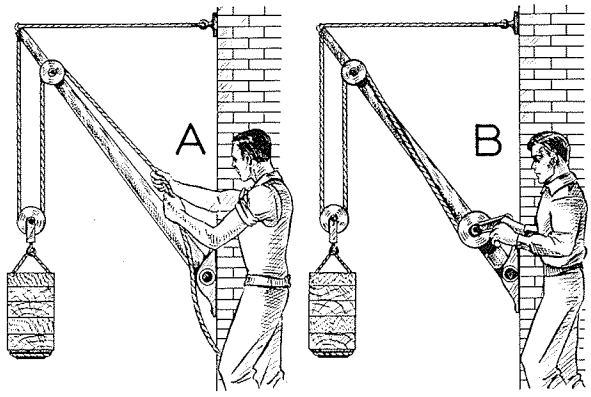
Which is the harder way to carry the hammer?
(If equal, mark C.)

PUT YOUR ANSWERS ON THE ANSWER SHEET.



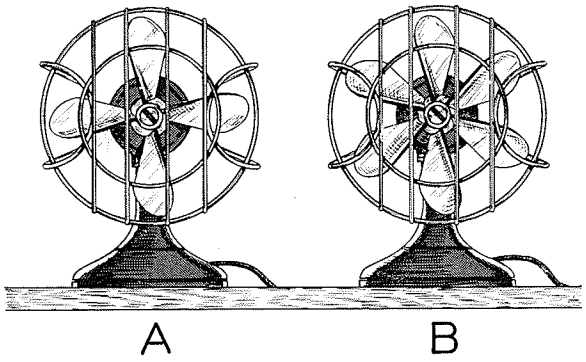
13

Which wheel will turn faster?
(If equal, mark C.)



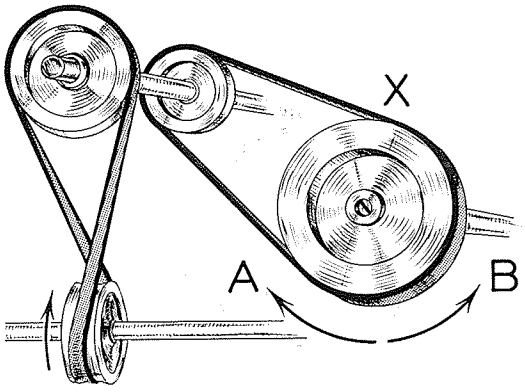
14

Which man can lift the weight more easily?
(If equal, mark C.)



15

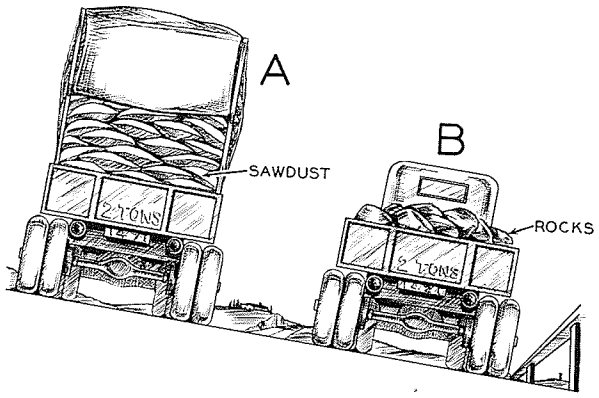
Which fan needs the more powerful motor?
(If equal, mark C.)



16

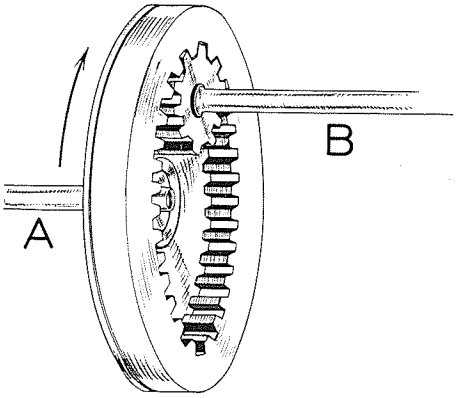
Which way will pulley "X" turn?
(If either, mark C.)

Do Not Stop. Go On to the Next Page.



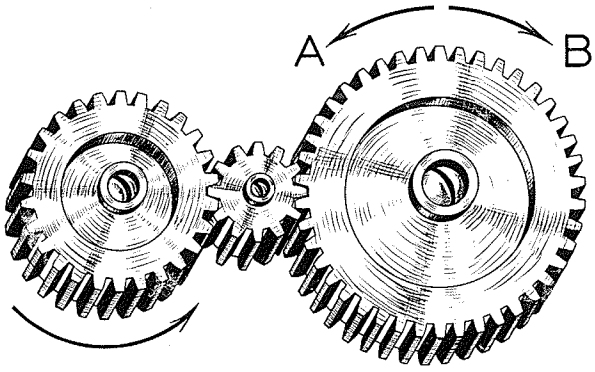
17

Which truck will turn over more easily?
(If equal, mark C.)



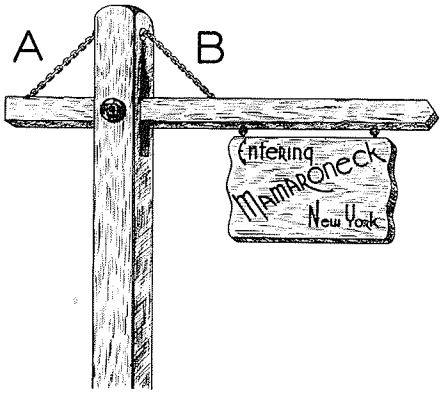
18

Which shaft turns faster?
(If equal, mark C.)



19

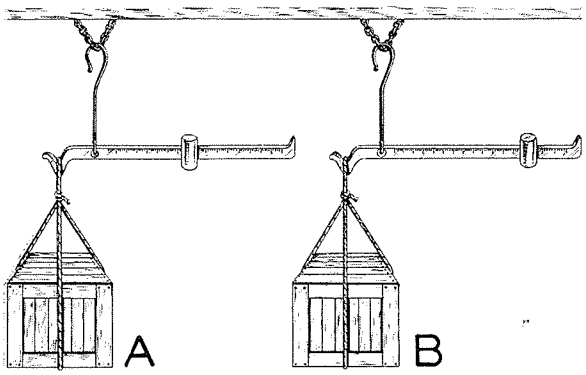
When the left-hand gear turns in the direction shown, which way does the right-hand one turn?
(If either, mark C.)



20

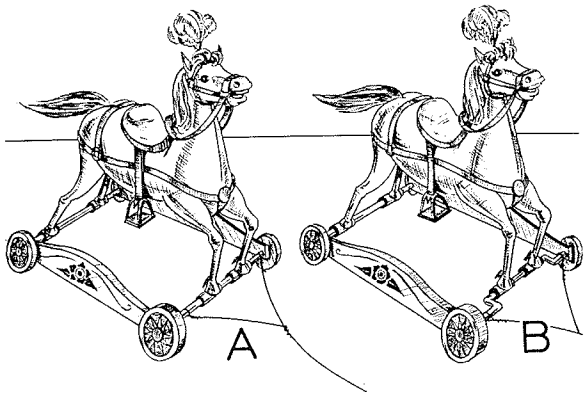
Which chain alone will hold up the sign?
(If either, mark C.)

PUT YOUR ANSWERS ON THE ANSWER SHEET.



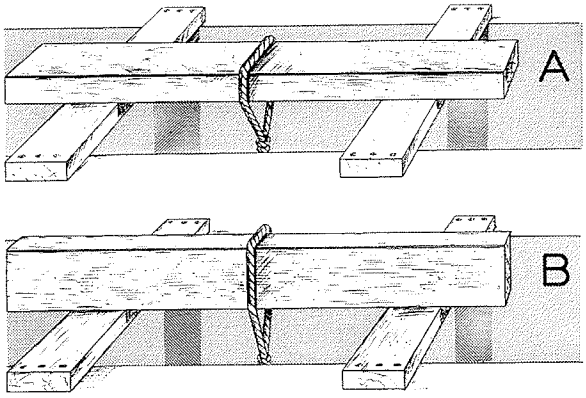
21

Which box weighs more?
(If equal, mark C.)



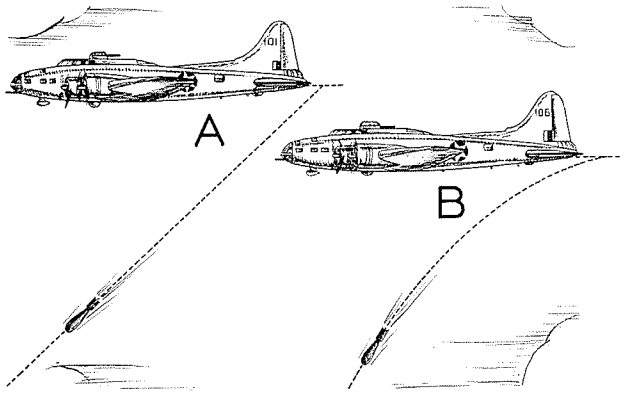
22

Which horse will jump more when it is pulled?
(If equal, mark C.)



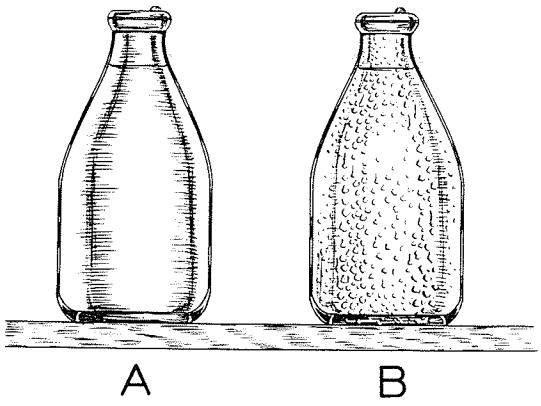
23

In which picture can you safely put a heavier weight on the rope?
(If equal, mark C.)



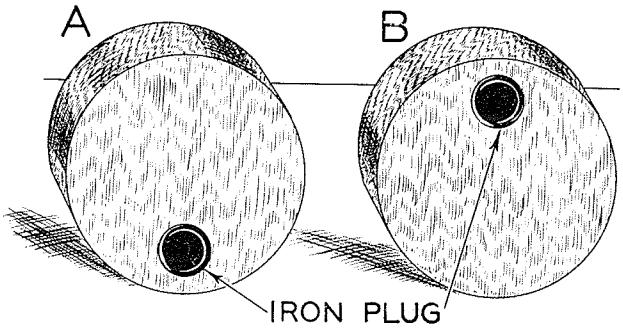
24

Which drawing shows how a bomb really falls?
(If both, mark C.)



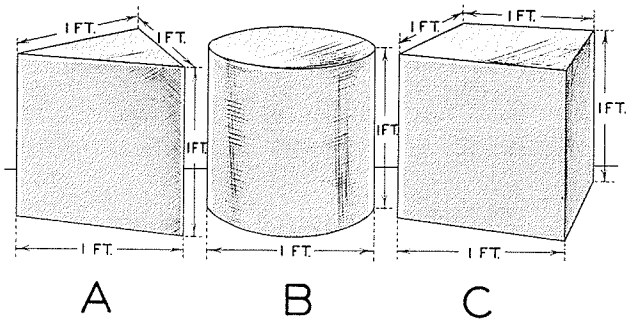
25

Which bottle has just been taken from the refrigerator?
(If neither, mark C.)



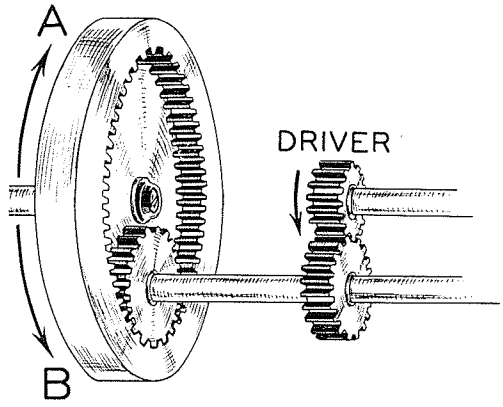
26

Which picture shows how this wooden circle will stand?
(If neither, mark C.)



27

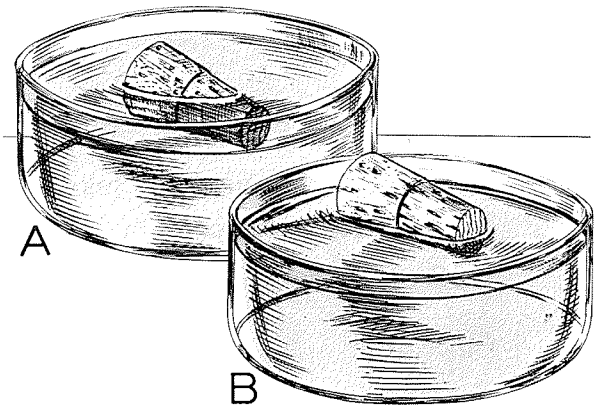
Which weighs least?



28

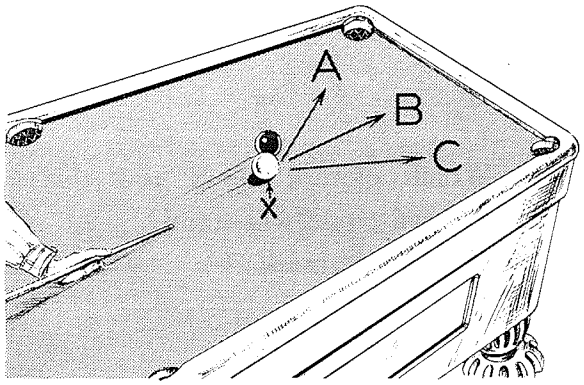
When the driver turns in the direction shown, which way will the left-hand gear turn?
(If either, mark C.)

PUT YOUR ANSWERS ON THE ANSWER SHEET.



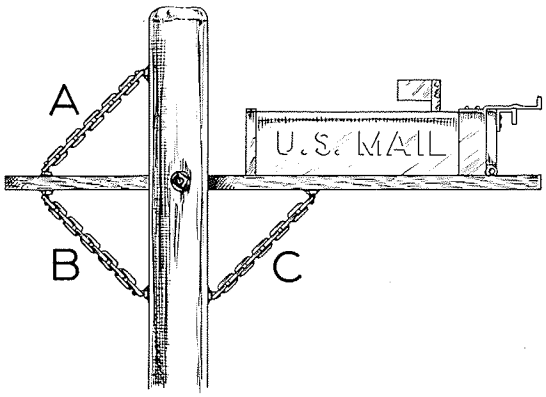
29

Which liquid is heavier?
(If equal, mark C.)



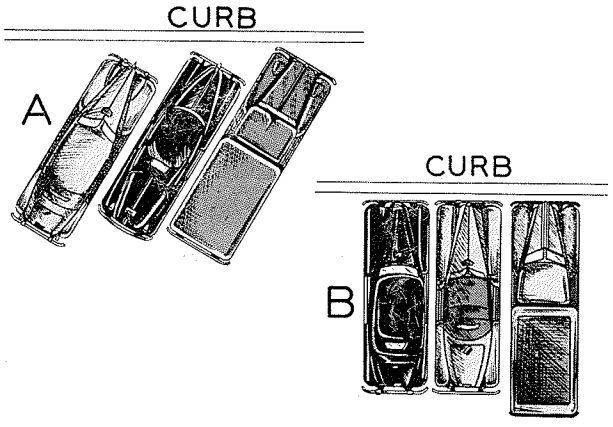
30

After hitting the black ball, which way will ball "X" go?



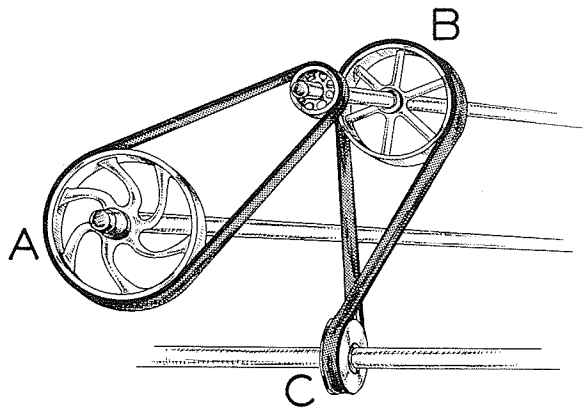
31

Which one piece of chain is needed to support the mail box?



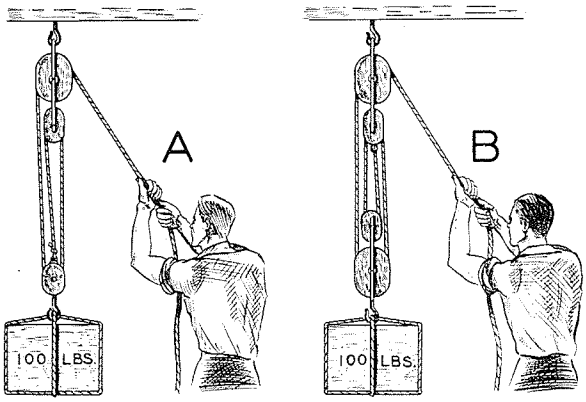
32

Which way can more cars be parked in a block?
(If equal, mark C.)



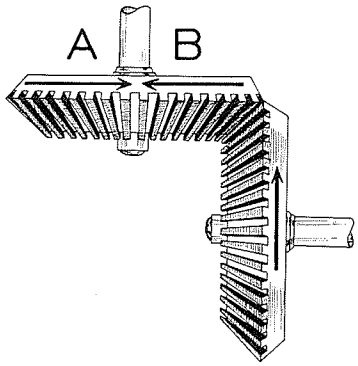
33

Which shaft will turn most rapidly?



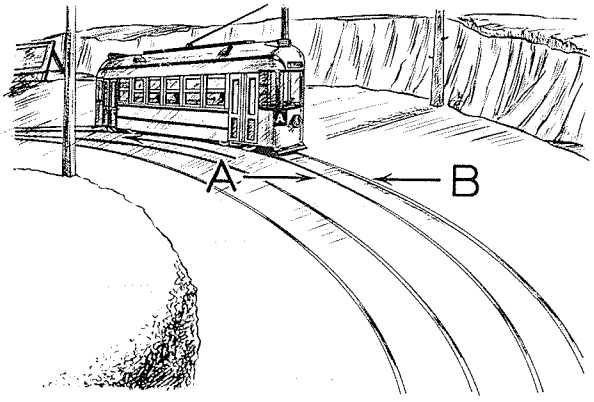
34

Which man can lift the load more easily?
(If equal, mark C.)



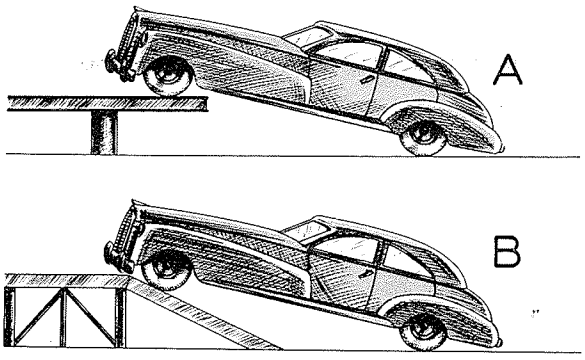
35

When the right-hand gear turns in the direction shown, which way does the top gear turn?
(If neither, mark C.)



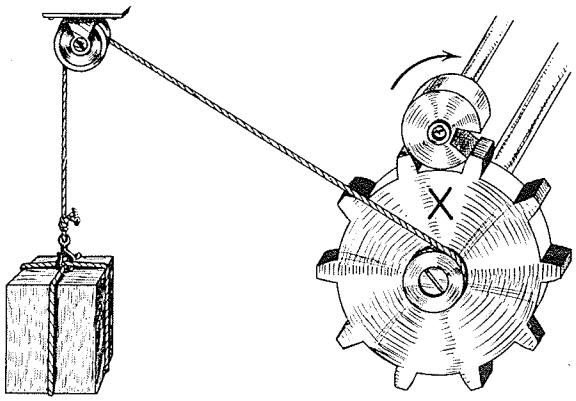
36

Which rail should be higher?
(If equal, mark C.)



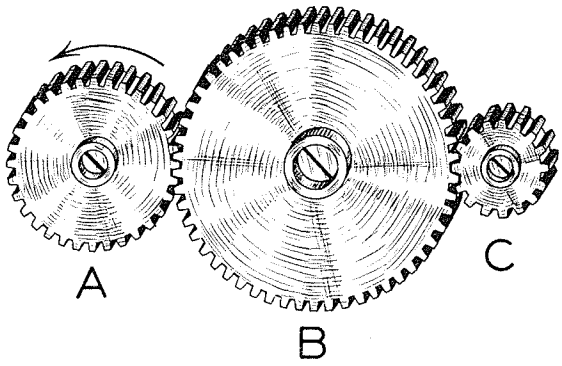
37

Which car is less likely to roll?
(If equal, mark C.)



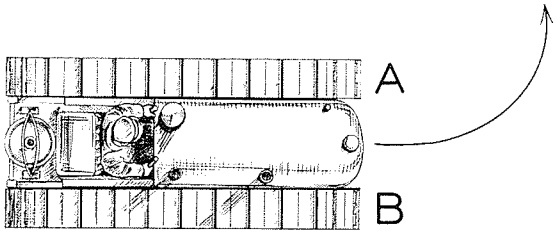
38

The top of wheel "X" will go:
(A) steadily to the right;
(B) steadily to the left;
(C) by jerks to the left.



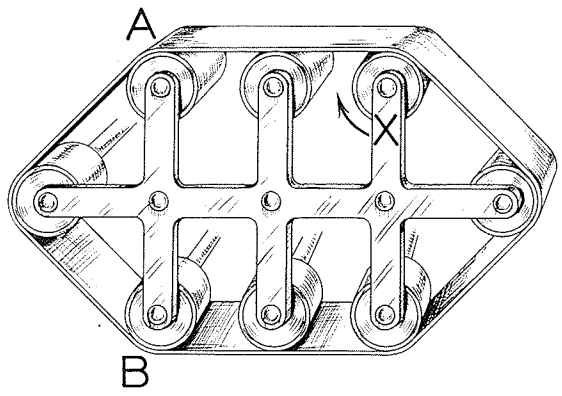
39

Which gear turns most times in a minute?



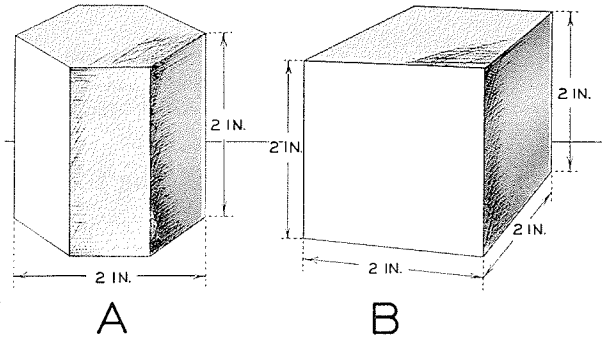
40

Which tread should be run more rapidly in order to turn the caterpillar tractor in the direction shown?
(If neither, mark C.)



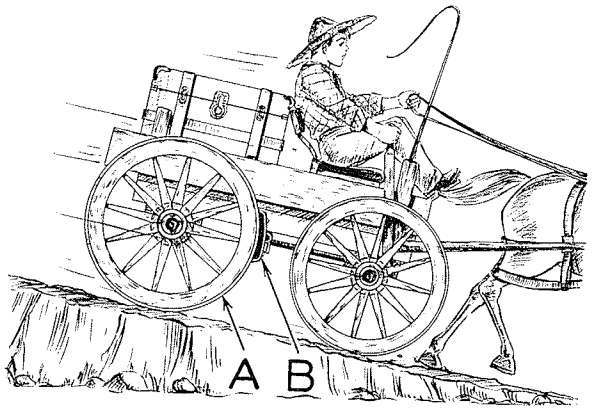
41

Which roller turns the same way as the roller at "X"?
(If both, mark C.)



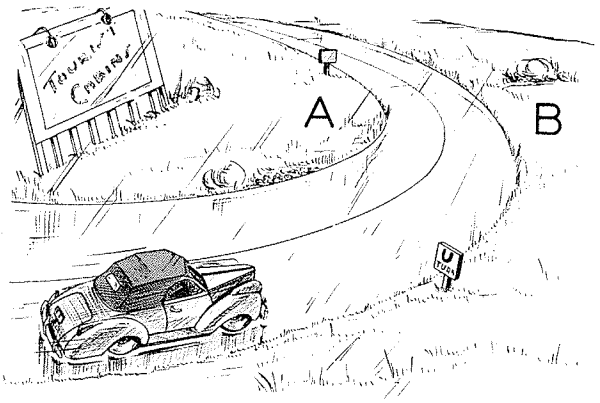
42

Which weighs more?
(If equal, mark C.)



43

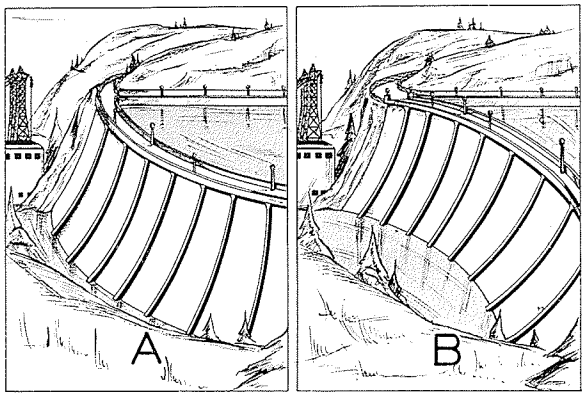
When the brake is put on, which part gets hotter?
(If equal, mark C.)



44

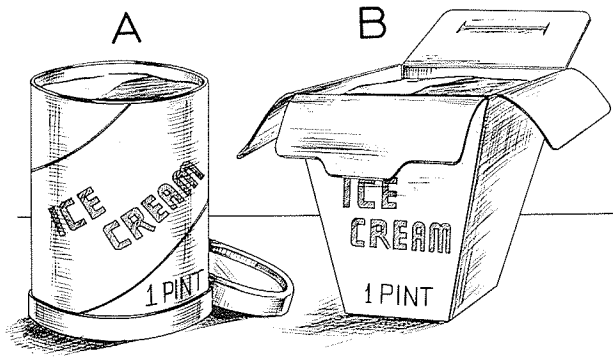
Off which side of the road is the car more likely to skid?
(If equal, mark C.)

PUT YOUR ANSWERS ON THE ANSWER SHEET.



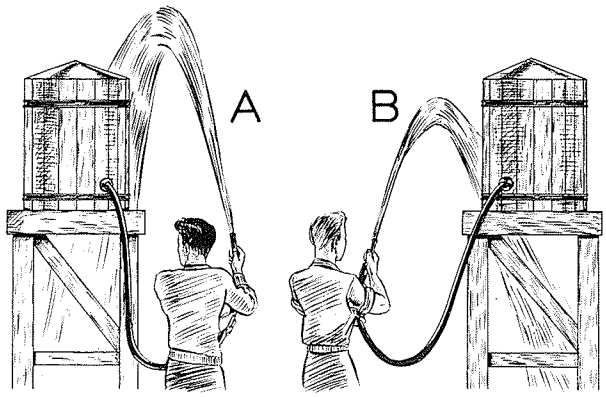
45

Which dam is stronger?
(If equal, mark C.)



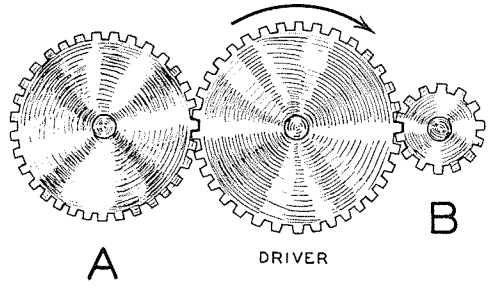
46

In which container will the ice cream stay hard longer?
(If equal, mark C.)



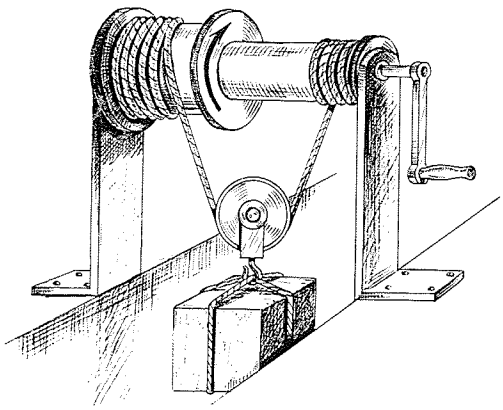
47

Which picture is correct?
(If both, mark C.)



48

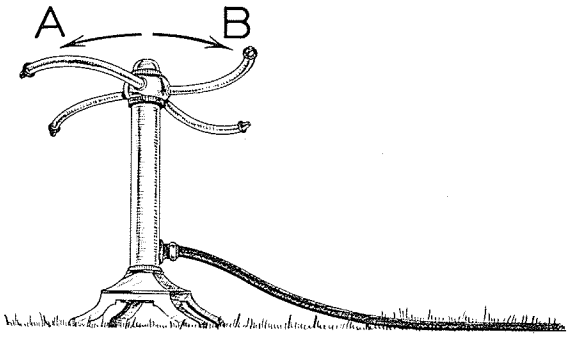
Which gear turns the same way as the driver?
(If neither, mark C.)



49

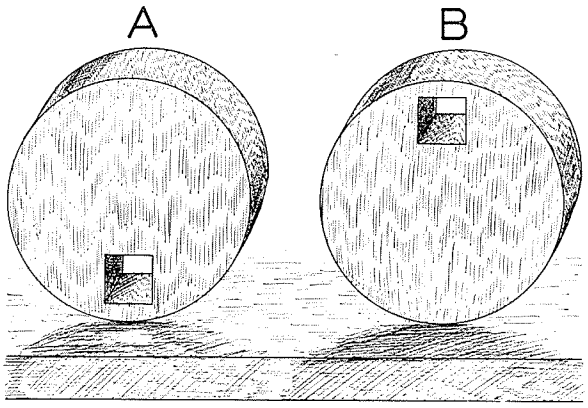
When the windlass is turned in the direction shown, the weight will:

(A) fall;
(B) stand still;
(C) rise.



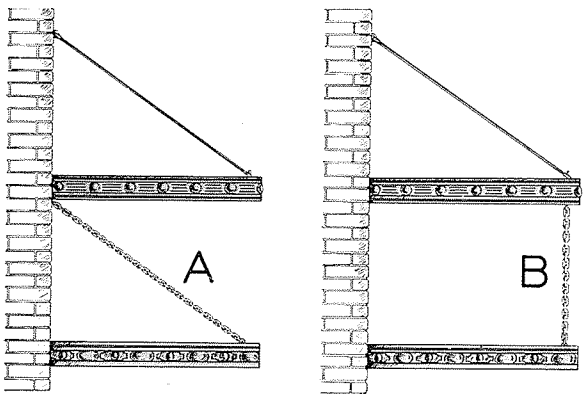
50

When the water is turned on, which way will the sprinkler turn? (If either, mark C.)



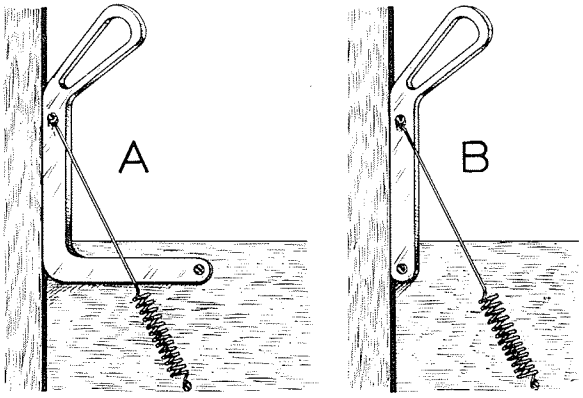
51

Which picture shows how this wooden circle will stand? (If neither, mark C.)



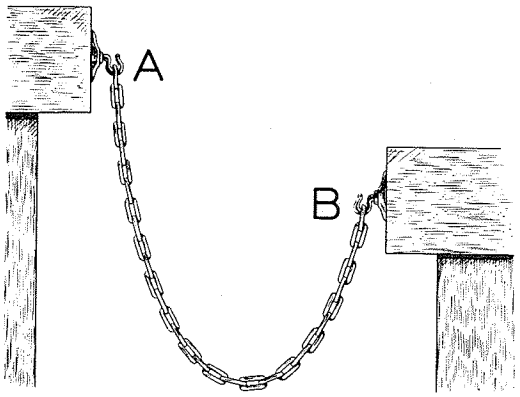
52

Which chain has more strain upon it? (If equal, mark C.)



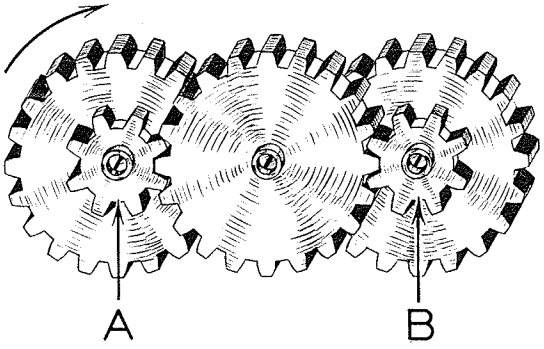
53

In which picture will the spring hold the handle where it now is?
(If both, mark C.)



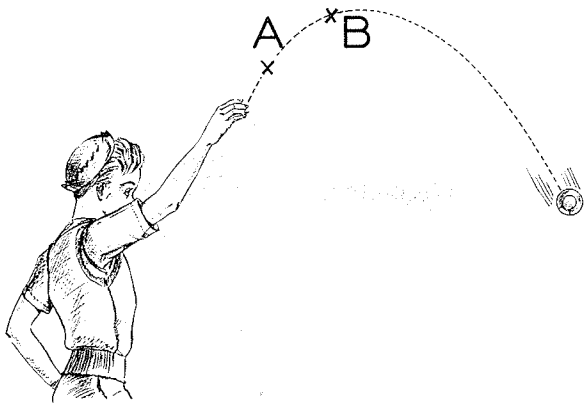
54

Which hook supports more weight?
(If equal, mark C.)



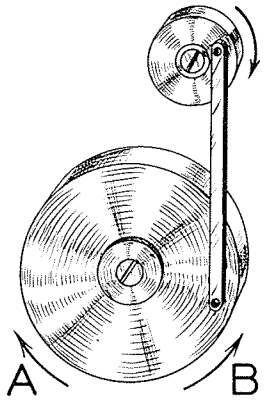
55

Which gear turns slower?
(If equal, mark C.)



56

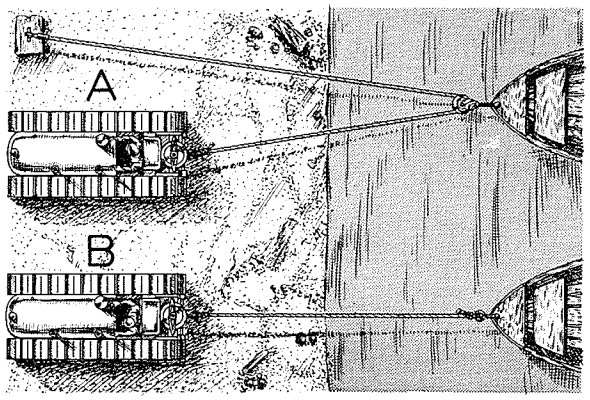
At which point was the ball going faster?
(If equal, mark C.)



57

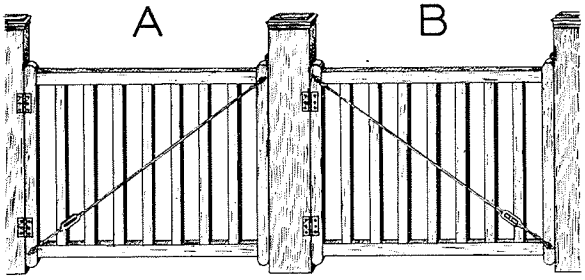
When the small wheel is turned around, the big wheel will:

(A) turn in direction A;
(B) turn in direction B;
(C) move back and forth.



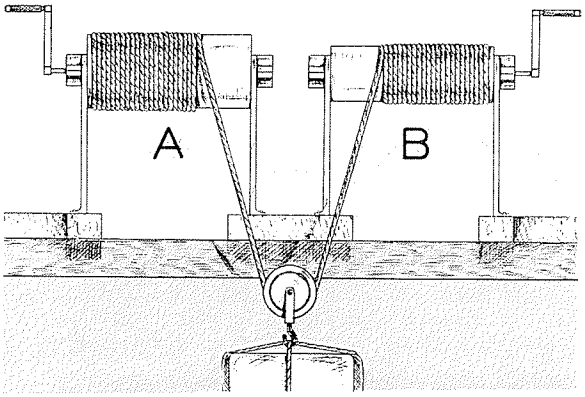
58

Which tractor must go further to pull the boat up on the beach? (If equal, mark C.)



59

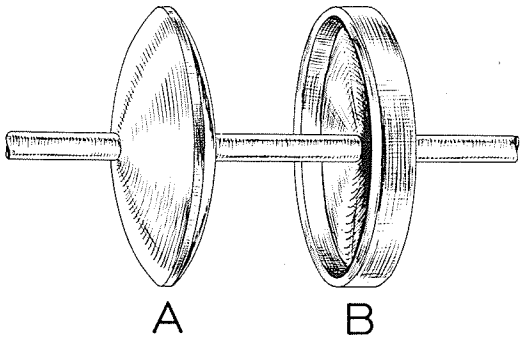
Which gate is better braced? (If equal, mark C.)



60

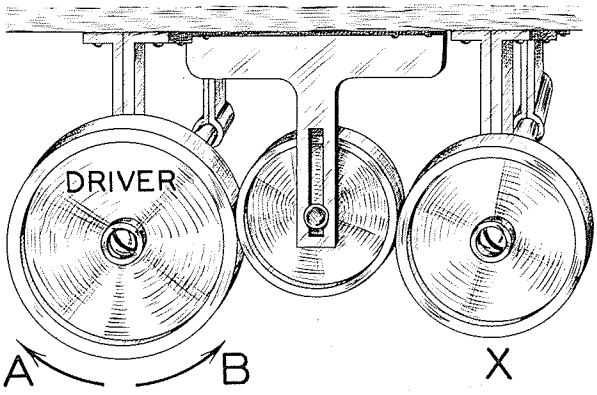
Which windlass will be harder to turn in order to lift the weight? (If equal, mark C.)

PUT YOUR ANSWERS ON THE ANSWER SHEET.



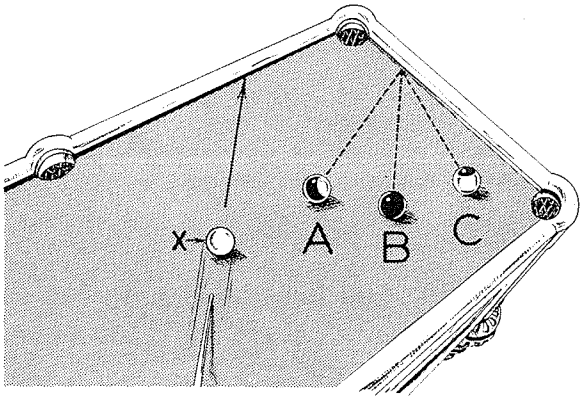
61

Which wheel is safer when spun at high speed?
(If equal, mark C.)



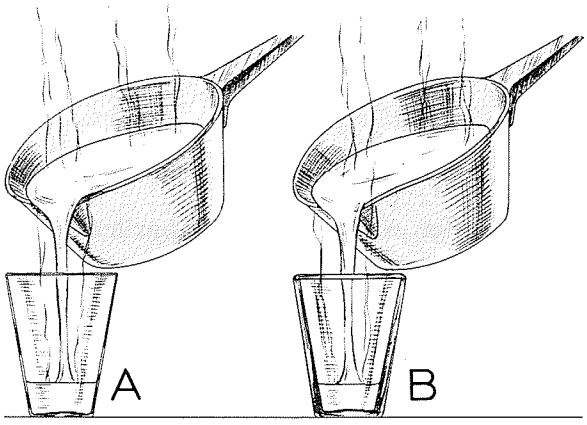
62

Which way must the driver turn to drive the wheel "X"?
(If either, mark C.)



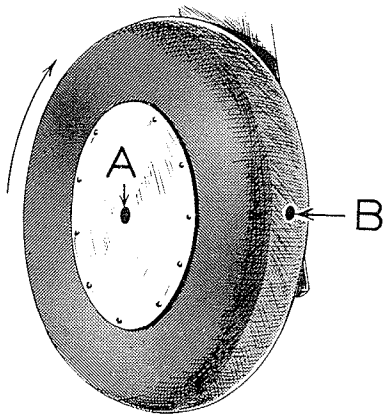
63

Which of these balls will the white ball "X" hit?



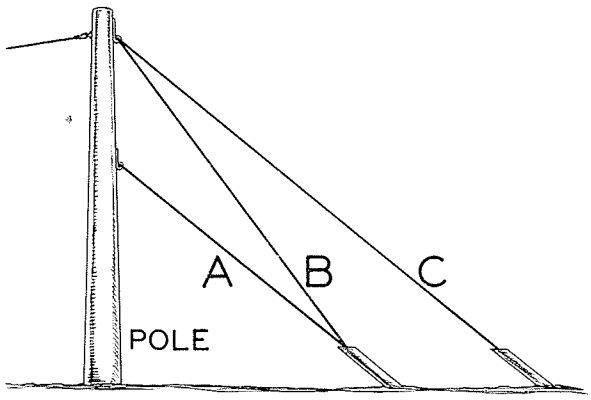
64

Which glass is more likely to break?
(If equal, mark C.)



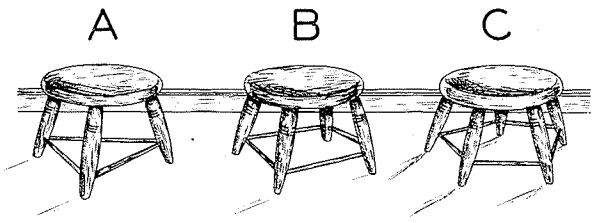
65

Which point moves faster when the wheel turns?
(If equal, mark C.)



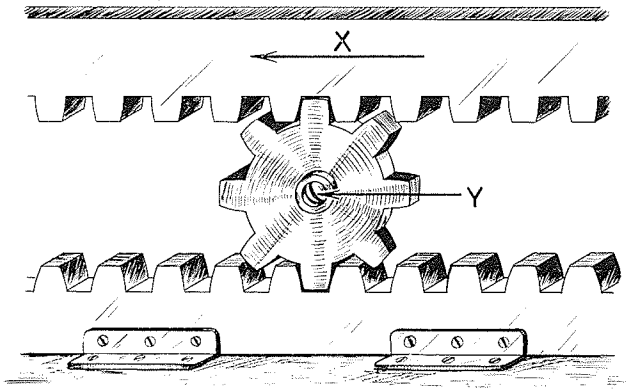
66

Which one piece of cable will give this pole the best support?



67

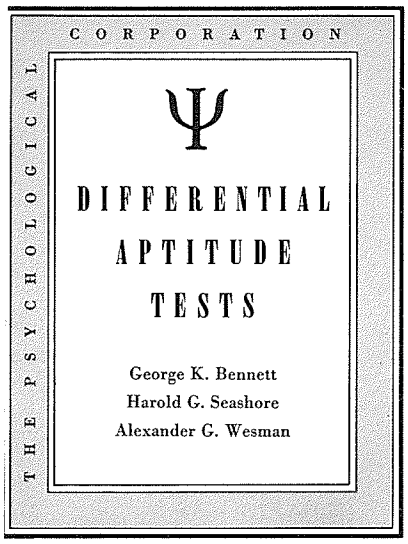
Which stool will be steadiest on uneven ground?



68

If "X" moves two feet in the direction shown, the center of the gear "Y" will move:

(A) more than two feet;
(B) less than two feet;
(C) two feet.



CLERICAL

SPEED AND ACCURACY

FORM A

Do not open this booklet until you are told to do so.

On your SEPARATE ANSWER SHEET, print your name, address, and other requested information in the proper spaces.

Then wait for further instructions.

DO NOT MAKE ANY MARKS IN THIS BOOKLET

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56-149 TB

Do not make any marks in this booklet

SPEED AND ACCURACY

Mark your answers on the separate Answer Sheet

DIRECTIONS

This is a test to see how quickly and accurately you can compare letter and number combinations. On the following pages are groups of these combinations; each Test Item contains five. These same combinations appear after the number for each Test Item on the separate Answer Sheet, but they are in a different order. You will notice that in each Test Item one of the five is **underlined.** You are to look at the **one** combination which is underlined, find the **same** one after that item number on the separate Answer Sheet, and fill in the space under it.

These examples are correctly done. Note that the combination on the Answer Sheet must be exactly the same as the one in the Test Item.

TEST ITEMS

V.	AB	AC	AD	AE	AF
W.	aA	aB	BA	Ba	Bb
X.	A7	7A	B7	7B	AB
Y.	Aa	Ba	bA	BA	bB
Z.	3A	3B	33	B3	BB

SAMPLE OF ANSWER SHEET

V	AC	AE	AF	AB	AD
W	BA	Ba	Bb	aA	aB
X	7B	B7	AB	7A	A7
Y	Aa	bA	bB	Ba	BA
Z	BB	3B	B3	3A	33

If you finish the items in Part I before time is called, check your work. Do **not** turn to Part II until you are told to do so. Work as fast as you can.

DO NOT TURN THE PAGE UNTIL YOU ARE TOLD TO DO SO.

PART I

1.	nv	nx	xn	vx	xv	26.	ud	un	nd	nu	du
2.	bl	dl	ld	lb	bd	27.	fk	lk	kf	lf	kl
3.	ar	au	ur	ra	ru	28.	pq	qg	gp	gq	qp
4.	wu	vu	vw	wv	uw	29.	2u	2q	qu	q2	u2
5.	wm	um	mu	wu	mw	30.	41	44	14	11	40
6.	79	76	67	69	97	31.	nr	ne	en	rn	re
7.	ra	na	nr	rn	ar	32.	bb	dd	ld	db	bd
8.	za	mz	zm	az	ma	33.	RB	RD	DR	BR	BD
9.	AV	VN	NV	NA	VA	34.	MW	MV	VW	VM	WM
10.	OQ	CQ	QC	QO	OC	35.	OD	OB	BD	DO	BO
11.	CU	UU	UC	US	CC	36.	PR	PB	RB	RP	BP
12.	4H	4N	NH	N4	HN	37.	Dd	Db	dB	bB	DD
13.	Rr	RP	pR	PP	rr	38.	EE	Ef	eF	Fe	FF
14.	Aa	A8	8a	8A	aA	39.	Ze	Zz	ZE	zE	eZ
15.	LT	Tt	tT	Tl	tt	40.	Zz	NZ	zZ	zn	ZN
16.	Av	Vv	av	VV	AA	41.	7c	9b	9c	9e	7b
17.	4d	3c	4a	4c	3a	42.	7c	2b	7b	2d	7d
18.	X7	V9	V5	X9	V7	43.	n3	Sn	3s	ns	3n
19.	A9	7b	79	9b	b7	44.	20	25	02	05	52
20.	20	25	02	05	52	45.	ec	ac	ca	ce	ae
21.	ar	ra	ro	or	oa	46.	2h	h4	42	4h	24
22.	lc	lo	ol	oc	co	47.	av	va	vo	ao	ov
23.	1s	13	31	3s	s1	48.	fa	fr	ra	rf	ar
24.	ma	cm	ca	mc	am	49.	ma	cm	ca	mc	am
25.	xv	vx	vw	wx	wv	50.	rc	cr	co	oc	or

GO ON TO THE NEXT PAGE AND KEEP RIGHT ON WORKING.

51.	ch	ho	hc	oc	oh
52.	se	rs	re	es	er
53.	ar	au	ur	ra	ru
54.	pq	qg	gp	gq	qp
55.	am	na	nm	mn	an

56.	gj	jg	pg	jp	gp
57.	tp	et	ep	pe	pt
58.	ra	na	nr	rn	ar
59.	bb	dd	ld	db	bd
60.	18	81	1a	8a	a8

61.	HN	HZ	ZH	ZN	NH
62.	RR	BR	RB	BB	RP
63.	CU	UU	UC	US	CC
64.	PR	PB	RB	RP	BP
65.	CK	KJ	JC	KC	JK

66.	T1	1T	11	Tt	TT
67.	SX	sX	sx	Xs	XS
68.	LT	Tt	tT	Tl	tt
69.	Zz	NZ	zZ	zn	ZN
70.	GQ	Qg	qq	qg	QG

71.	4c	1a	1c	4d	2d
72.	S8	C3	S3	C8	C5
73.	A9	7b	79	9b	b7
74.	18	81	71	78	17
75.	b4	4d	db	d4	bd

76.	u6	u4	4u	6u	46
77.	3x	7x	73	37	x7
78.	1s	13	31	3s	s1
79.	en	dn	de	ed	nd
80.	ni	fi	fn	in	nf

81.	35	53	h3	3h	5h
82.	bl	dl	ld	lb	bd
83.	fk	lk	kf	lf	kl
84.	69	6d	9d	d6	d9
85.	XX	VX	VZ	ZV	XV

86.	j8	a8	8a	8j	ja
87.	79	76	67	69	97
88.	nr	ne	en	rn	re
89.	4X	4V	Vx	V4	X4
90.	vn	vz	zv	nv	zn

91.	B8	R8	8B	RB	8R
92.	OQ	CQ	QC	QO	OC
93.	OD	OB	BD	DO	BO
94.	ZY	ZX	XY	YZ	YX
95.	OU	OC	UC	UO	CO

96.	Cc	Oc	OO	cO	cc
97.	Aa	A8	8a	8A	aA
98.	Ze	Zz	ZE	zE	eZ
99.	BP	Pb	bP	pp	bB
100.	Cz	CZ	Zc	zC	cz

STOP. DO NOT TURN THE PAGE UNTIL YOU ARE TOLD TO DO SO.

PART II

1.	YZ	VY	VX	XY	ZY
2.	b9	c6	69	96	6c
3.	ou	oa	ua	uo	ao
4.	lc	lo	ol	oc	co
5.	X7	V9	V5	X9	V7
6.	Sc	8c	8s	cS	c8
7.	ob	bt	ot	tb	bo
8.	5e	3d	4d	2e	2d
9.	rc	dc	dr	rd	cr
10.	ws	sw	st	tw	ts
11.	wm	um	mu	wu	mw
12.	pp	qq	pq	pg	qp
13.	nv	nx	xn	vx	xv
14.	nu	un	um	mn	mu
15.	zn	zz	nz	nn	mn
16.	pg	gy	py	yp	yg
17.	59	9Y	5Y	Y9	95
18.	nu	on	ou	un	uo
19.	ud	un	nd	nu	du
20.	41	44	14	11	40
21.	Rr	RP	pR	PP	rr
22.	LT	IT	IL	TL	TI
23.	MW	MV	VW	VM	WM
24.	Uu	Wu	uW	WW	uU
25.	3x	xc	c3	cx	3c
26.	AV	VN	NV	NA	VA
27.	YX	XX	Yy	Xy	xX
28.	EL	FL	FE	LF	LE
29.	MN	NM	VN	MV	NV
30.	EE	Ef	eF	Fe	FF
31.	S8	C8	8C	8S	S5
32.	h6	h8	86	8h	6h
33.	4d	3c	4a	4c	3a
34.	Z4	Z1	14	1Z	4Z
35.	Qo	Qq	OQ	oq	QQ
36.	xc	ex	ec	ce	xe
37.	ar	ra	ro	or	oa
38.	8c	8a	7a	6c	7c
39.	us	ue	se	su	eu
40.	wo	ro	rw	ow	wr
41.	wu	vu	vw	wv	uw
42.	er	ri	ir	ie	re
43.	31	23	32	13	21
44.	2u	2q	qu	q2	u2
45.	xv	vx	vw	wx	wv
46.	ae	et	ea	ta	te
47.	VI	SI	SV	VS	IV
48.	th	he	et	eh	ht
49.	za	mz	zm	az	ma
50.	sx	sa	ax	xs	xa

GO ON TO THE NEXT PAGE AND KEEP RIGHT ON WORKING.

51.	Av	Vv	aV	VV	AA
52.	Mw	wW	WM	MM	mW
53.	4H	4N	NH	N4	HN
54.	Dd	Db	dB	bB	DD
55.	S8	83	S3	38	3S

56.	XO	OO	OX	OV	XX
57.	S8	C8	8C	8S	S5
58.	X7	V9	V5	X9	V7
59.	L7	L1	17	1L	7L
60.	RB	RD	DR	BR	BD

61.	18	81	71	78	17
62.	Vv	Ww	Wv	wV	vv
63.	Mm	MN	NN	nn	mM
64.	b9	c6	69	96	6c
65.	4c	1a	1c	4d	2d

66.	2h	h4	42	4h	24
67.	YZ	VY	VX	XY	ZX
68.	n3	Sn	3s	ns	3n
69.	wo	ro	rw	ow	wr
70.	ar	ra	ro	or	oa

71.	ni	fi	fn	in	nf
72.	wu	vu	vw	wv	uw
73.	th	he	et	eh	ht
74.	am	na	nm	mn	an
75.	3x	7x	73	37	x7

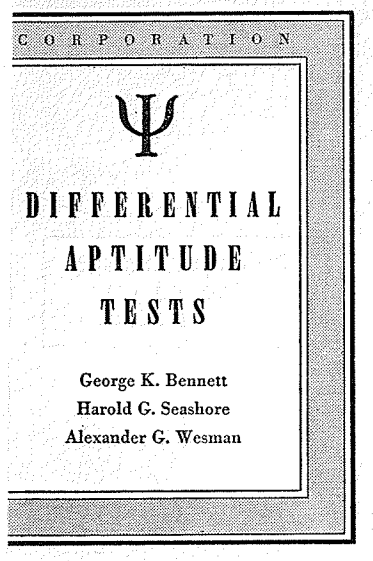
76.	j8	a8	8a	8j	ja
77.	59	9Y	5Y	Y9	95
78.	fk	lk	kf	lf	kl
79.	ma	cm	ca	mc	am
80.	nv	nx	xn	vx	xv

81.	se	rs	re	es	er
82.	4X	4V	VX	V4	X4
83.	zn	zz	nz	nn	mn
84.	LT	IT	IL	TL	TI
85.	41	44	14	11	40

86.	us	ue	se	su	eu
87.	PR	PB	RB	RP	BP
88.	Rr	RP	pR	PP	rr
89.	SX	sX	sx	Xs	XS
90.	ra	na	nr	rn	ar

91.	OU	OC	UC	UO	CO
92.	RB	RD	DR	BR	BD
93.	XX	XO	OO	OX	OV
94.	HN	HZ	ZH	ZN	NH
95.	Av	Vv	aV	VV	AA

96.	OQ	CQ	QC	QO	OC
97.	Ze	Zz	ZE	zE	eZ
98.	GQ	Qg	qq	qg	QG
99.	Mm	MN	NN	nn	mM
100.	Qo	Qq	OQ	oq	QQ



LANGUAGE USAGE

FORM A

Do not open this booklet until you are told to do so.

On your SEPARATE ANSWER SHEET, print your name, address, and other requested information in the proper spaces.

In the space after **Form,** print an **A.**

Then wait for further instructions.

DO NOT MAKE ANY MARKS IN THIS BOOKLET.

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55-189TB

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LANGUAGE USAGE

Mark your answers on the separate Answer Sheet

Part I
SPELLING

DIRECTIONS

This test is composed of a series of words. Some of them are correctly spelled; some are incorrectly spelled. You are to indicate whether each word is spelled right or wrong by blackening the proper space on the separate Answer Sheet. If the spelling of the word is **right**, fill in the space under RIGHT. If it is spelled **wrong**, fill in the space under WRONG.

EXAMPLES

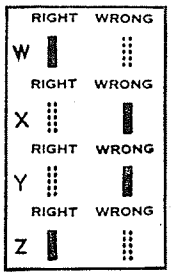
W. man

X. gurl

Y. catt

Z. dog

SAMPLE OF ANSWER SHEET



If you finish Part I before time is called, check your work. Do not go on to Part II until you are told to do so.

DO NOT TURN OVER THE BOOKLET UNTIL YOU ARE TOLD TO DO SO.

1. apointed
2. commission
3. limited
4. arival
5. comunity
6. variety
7. agentcy
8. distrubute
9. hereafter
10. conference
11. salery
12. preveous
13. colusion
14. director
15. essential
16. cilinder
17. astablish
18. quarrel
19. premeum
20. relize
21. gratitude
22. sugestion
23. consinment
24. revenue
25. inferier
26. condem
27. absolutely
28. cancel
29. carreer
30. bullitin
31. oposition
32. ammunition
33. survay
34. energey
35. sundery
36. visinity
37. sheriff
38. pamflet
39. conserning
40. securety
41. necessity
42. expences
43. testomony
44. avalable
45. stating
46. courtesy
47. naturaly
48. apoligy
49. invilid
50. construction

TURN THE PAGE AND KEEP RIGHT ON WORKING.

51. secratary
52. duplacate
53. gosple
54. traffic
55. captian
56. sanatary
57. specimen
58. accommodate
59. Sabbath
60. consious
61. athority
62. owing
63. emergancy
64. opperation
65. sylable
66. talant
67. nourish
68. ignorence
69. behavor
70. exceedingly
71. murmer
72. signiture
73. guardian
74. interrupt
75. congradulate
76. deploma
77. abundent
78. tedious
79. dilegent
80. aquainted
81. resonable
82. customery
83. muslin
84. investagation
85. temperary
86. indignant
87. wretched
88. unusal
89. definate
90. garrulous
91. allowence
92. appropriate
93. rememberance
94. presense
95. caisson
96. appendicitis
97. convienient
98. occured
99. intuition
100. greatful

STOP HERE AND WAIT FOR FURTHER INSTRUCTIONS.

Do not make any marks in this booklet

LANGUAGE USAGE

Mark your answers on the separate Answer Sheet

Part II
SENTENCES

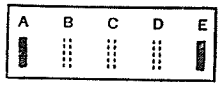
DIRECTIONS

This test consists of a series of sentences, each divided into five parts lettered A, B, C, D, and E. You are to look at each and decide which of the lettered parts have errors in grammar, punctuation or spelling. When you have decided which parts are wrong, fill in the space under those letters after that item number on the separate Answer Sheet.

EXAMPLE

Ain't we / going to the / office / next week / at all.
A B C D E

SAMPLE OF ANSWER SHEET



The space under A has been filled in because "ain't" is wrong; the space under E has been blackened because "at all" should be followed by a question mark. There is nothing wrong in Parts B, C and D, so the spaces under those letters have been left blank.

Some of the sentences are entirely correct. Others may have from **one** to **five** parts wrong. For each part of each sentence which you think is wrong, blacken the space under that letter on the separate Answer Sheet.

DO NOT TURN THE PAGE UNTIL YOU ARE TOLD TO DO SO.

1. Where / did you / stop at / on your trip / to Chicago.
   A B C D E

2. Was it / him / who / got burned / when the boiler bursted?
   A B C D E

3. The dog laid / sleeping / after chasing John and I / with hardly no / time out.
   A B C D E

4. I doubt / if Jack / has fewer / than sixteen / baseball bats.
   A B C D E

5. "It is me," / said Will, / as his mother / answered / his knock.
   A B C D E

6. If I were / he, / I'd be / sure / of myself.
   A B C D E

7. I could / of won / if I had stood / in the game / a little longer.
   A B C D E

8. If John were here / he'd sure / have done / faster work / than Fred.
   A B C D E

9. I can't hardly / raise my hand / more than / three foot / above the board.
   A B C D E

10. I sung / until / I was hoarse, / and then drunk / a quart of water.
    A B C D E

11. Neither money / or fame / would of been / alright as payment / for such a job.
    A B C D E

12. I don't understand / how anyone / could admire / a person as careless / as her.
    A B C D E

13. Is it / I / whom / they / are calling?
    A B C D E

14. I didn't feel / good enough / to attend / the conference / last tuesday.
    A B C D E

15. I did / pretty good / in history / on last / week's quizzes.
    A B C D E

16. Her father replied / "I feel / that Carol / is some better / than Mary."
    A B C D E

17. The rivers raised / ten feet / after the rains, / overflowing / their banks.
    A B C D E

18. I thought / you was through / doing / your work / all ready.
    A B C D E

19. We O.K.'d / there proposal / that we cooperate / for our / mutual profit.
    A B C D E

20. The writer / made / an illusion / to his hero's / earlier exploits.
    A B C D E

21. I don't like / those kind / of peaches; / give me some / of the ripe ones.
    A B C D E

22. Leave / me go / with John / and she / to the show.
    A B C D E

23. He is / one of those men / who works / well / and long.
    A B C D E

24. James said, / "Work, / not words, / is what / is needed."
    A B C D E

25. None of the books / were / worth reading / more then / once or twice.
    A B C D E

GO ON TO THE NEXT PAGE AND KEEP RIGHT ON WORKING.

26. They / nearly were / starved / before they landed / somewheres in Florida.
A B C D E

27. She / got hurt / when the dish / busted / in her hands.
A B C D E

28. I thought it / was him, / and it sure / looked like him / from this distance.
A B C D E

29. Who / do you / think / your / talking about?
A B C D E

30. The number / of volunteers / were / seldom ever / enough.
A B C D E

31. One issue of bonds / were / distributed / between / three banks.
A B C D E

32. There goes / John and Bill, / fighting / like / always.
A B C D E

33. Is it / me / who / you wanted / to see?
A B C D E

34. I don't see / as good / as Tom, / my friend / can.
A B C D E

35. Paul had / promised / to return / the book / in two weeks.
A B C D E

36. The man who / everybody likes / is one / who / they can trust.
A B C D E

37. He asked / we three, / "where / is the folks / which lived here?"
A B C D E

38. I've had / less headaches / since I / went to sleep / earlier.
A B C D E

39. The books / laid / in the grass / all day / and got wet.
A B C D E

40. You can / leave the house / in an hour / if you feel / good.
A B C D E

41. I will / be real glad / to visit you / whenever / you would prefer.
A B C D E

42. The bible / is one / of the best books / their / are for serious study.
A B C D E

43. Each of / these flowers / look best / in a different / sort of a plot.
A B C D E

44. We allways turn / to who / we use to / know. the old friend / is best.
A B C D E

45. Being that / a pipe bust, / we hadn't / hardly / any water.
A B C D E

46. He had smoked / their tobacco, / drank their wine / and heard / their tales.
A B C D E

47. A man, / who beats his wife, / is considered depraved / by people / nowadays.
A B C D E

48. We seldom ever / have to / watch close / in our kind / of a job.
A B C D E

49. If it was possible, / we would of / gave him / the workers / which he wanted.
A B C D E

50. Neither Jones / nor Smith / are / the men / for that sort of a job.
A B C D E

THIS IS THE END OF THE TEST. CLOSE YOUR BOOKLET.