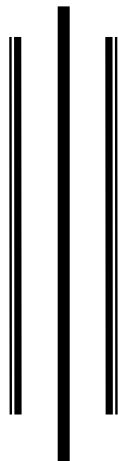


**MAJOR UNITS CAUSING HIGHER FAILURE RATE IN
MATHEMATICS IN THE DISTRICT LEVEL EXAMINATION
OF CLASS VIII**



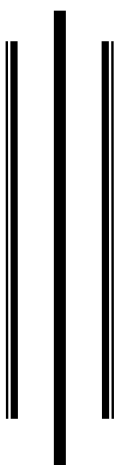
A T H E S I S

SUBMITTED BY

RAM KRISHNA KOIRALA

TU REGD NO: 55610 - 91

**FOR THE PARTIAL FULFILMENT OF REQUIREMENT FOR THE DEGREE
MASTER OF MATHEMATICS EDUCATION**



**TO
TRIBHUVAN UNIVERSITY
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Thesis Submitted by

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Entitled

**MAJOR UNITS CAUSING HIGHER FAILURE RATE IN
MATHEMATICS IN THE DISTRICT LEVEL**

EXAMINATION OF CLASS VIII has been approved in partial fulfillment of requirements for the degree Master of Education.

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This is to certify that Ram Krishna Koirala, student enrolled in the university in the academic year 2060/2062 with TU Registration No. 55610-91 and examination Roll No. 480487 (065) has completed this research paper under my supervision during the prescribed period abiding the rules and regulations of TU. The research paper entitled "**Major Units Causing Higher Failure Rate in Mathematics in the District Level Examination of Class VIII**" embodies the results of his investigation conducted during 2008/2009 under the Department of Mathematics, Prithvi Narayan Campus, Pokhara. I recommend and forward this thesis to be submitted as the partial fulfillment for awarding the degree of Master of Education in Mathematics.

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ABSTRACT

Mathematics is one of the difficult subjects in the eyes of the students all over the world. The results of various standardized tests show that the students' achievement in mathematics is comparatively lower than that in the other subjects. Several research works were conducted to find out the causes why mathematics leads the students to failure. But the similar works as to find the units which play the vital roles in making the students fail in the standardized test like the district level examination of class VIII are very rare and in fact no work of this type was found before. Thus with an intension of finding the units which play major role in making the students fail in district level examination of class VIII, this research work is endeavored to carry out.

The major objective of the study is thus to find out the units that play significant role in making students unsuccessful in mathematics of the district level examination of class eight. In other words the study is subject to find whether all the units are equally responsible in failure of the students or if all the failed students are evenly distributed over all the units taught in the class.

Eighty students from different schools of Kaski district and fifteen teachers who involved in checking the answer sheets of the district level examination were included in the sample of the study. An achievement test was conducted among those students and their scores in the test were analyzed first by dividing all into three groups according to the scores they obtained and then by using a non-parametric test (Chi-square test) within each group. Similarly a questionnaire was developed to collect the views of teacher and the data so collected was analyzed by observing the numerical differences.

The study concluded that all the units are not equally responsible for the failure of the students in the district level examination. The units like Geometry and Arithmetic comparatively play greater role in making the students fail than the other units.

CONTENTS

| | Page No. |
|--|----------|
| Acknowledgement | I |
| Abstract | II |
| Contents | III |
| List of Tables | V |
| List of Abbreviations | VI |
| CHAPTER – I | |
| INTRODUCTION | 1 |
| 1.1 Background of the Study | 2 |
| 1.2 Statement of the Problem | 7 |
| 1.3 Rationale of the Study | 8 |
| 1.4 Research Questions | 9 |
| 1.5 Objectives of the Study | 10 |
| 1.6 Statements of the Statistical Hypothesis | 10 |
| 1.7 Delimitation of the Study | 10 |
| 1.8 Definition of the Terms | 11 |
| CHAPTER – II | |
| REVIEW OF RELATED LITERATURE | 13 |
| CHAPTER – III | |
| METHODOLOGY | 16 |
| 3.1 Research Design | 16 |
| 3.2 Population of the Study | 16 |
| 3.3 Sample of the study | 17 |
| 3.4 Tools | 19 |
| 3.5 Item Analysis | 22 |
| 3.6 Data Collection Procedure | 26 |
| 3.7 Data Analysis Process | 27 |
| CHAPTER – IV | |
| ANALYSIS AND INTERPRETATION | 29 |
| 4.1 Comparison of Proportional Distribution on the basis of Unit wise Score | 30 |

| | | |
|--|--|----|
| 4.1.1 | Comparison of the distribution of warning students in different units | 30 |
| 4.1.2 | Comparison of distribution of Proficient students in different units | 32 |
| 4.1.3 | Comparison of distribution of Advanced students in different units | 34 |
| 4.2 | Interpretation of Data Related to Different Types of Weaknesses | 36 |
| 4.2.1 | Responses related to the units in which the questions were not attempted by moderate students | 36 |
| 4.2.2 | Responses related to the units in which the boarder students attempted but not accomplished | 38 |
| 4.2.3 | Responses related to the units in which the errors made by the students were inconsistent | 39 |
| 4.2.4 | Responses related to the units in which the learning achievements of the students are unreliable | 41 |
| 4.2.5 | Responses related to the units in which the learning outcomes seemed poor | 42 |
| 4.2.6 | Responses related to the units in which the mathematical knowledge and skill seemed poor | 44 |
| 4.2.7 | Responses related to the units which are responsible to the failure of students in mathematics | 46 |
| CHAPTER – V | | |
| SUMMARY, FINDING, CONCLUSION AND RECOMMENDATIONS | | 48 |
| 5.1 | Summary of the Study | 48 |
| 5.2 | Findings of the study | 49 |
| 5.3 | Conclusion of the study | 50 |
| 5.4 | Recommendations | 50 |

LIST OF TABLES

| | Page No. | |
|------------|---|----|
| Table – 1 | Number of Students in the Sample | 18 |
| Table – 2 | Reliability Calculation Table | 24 |
| Table – 3 | Criteria of Item Analysis on the Basis of Difficulty Level and Discrimination Index | 25 |
| Table – 4 | Number of Warning Students in Different Units and in Total | 30 |
| Table – 5 | Number of Proficient Students in Different Units and in Total | 32 |
| Table – 6 | Number of Advanced Students in Different Units and in Total | 34 |
| Table – 7 | Number of Respondent Teachers on Dropped Questions in Different Units by Moderate Students | 36 |
| Table – 8 | Number of Respondent Teachers on Units from which the Students Attempted but not accomplished | 38 |
| Table – 9 | Number of Respondent Teachers on Inconsistency of Mistakes Made by the Students in Different Units | 40 |
| Table – 10 | Number of Respondent Teachers on the Units from which the Students' Achievement is not Reliable | 41 |
| Table – 11 | Number of Respondent Teachers on the Units in which the Learning Outcomes Seemed Poor | 43 |
| Table – 12 | Number of Respondent Teachers on the Units in which the Mathematical Knowledge and Skill Seemed Poor | 45 |
| Table – 13 | Respondent Teachers on the Units Causing Failure of Students in Mathematics of District Level Examination of Class VIII | 46 |

LIST OF ABBREVIATIONS

| | |
|--------|--|
| NNEPC | – Nepal National Education Planning Commission |
| ARNEC | – All Round National Education Committee |
| NESP | – National Education System Plan |
| NEC | – National Education Committee |
| DEO | – District Education Office |
| SLC | – School Leaving Certificate |
| MD | – Difficulty in Mathematics |
| RD | – Difficulty in Reading |
| MANOVA | – Multivariate Analysis of Variance |
| ANOVA | – Analysis of Variance |
| CDC | – Curriculum Development Centre |

CHAPTER - I

INTRODUCTION

It has been realised in this ever dynamic age of science and technology that education should be so framed to cope with all social, economic, political, cultural, technological and teleological dynamisms. Mathematics is the only subject which has the significant correlation with all other studies. Thus, it plays a versatile role in the learning of almost all the disciplines. It is, in this regards, customary to say that a child with strong mathematical foundation can only be the efficient citizen as demanded by the nation of the time. In our context the school level education is considered as the foundation for the further studies. The school level education system is graded into four levels viz. Primary Level, Lower Secondary Level, Secondary Level and Higher Secondary Level. Mathematics is made one of the compulsory subjects in the former three levels but not so in the Higher Secondary Level. If we overview the school mathematics curriculum, we can find the inclusion of the different topics or units in the horizontal and vertical arrangement of the learning items in the different classes. Mathematics contents in the former classes of the school education are divided into three major headings viz. Arithmetic, Algebra and Geometry. But in the higher classes of the school, the division of the topics are further extended and the units like trigonometry, statistics, probability etc are also included.

The learning outcomes of the different school level education are measured by means of different standardised tests and examinations. Among them the district level examination of class VIII is one, which is administered by the District Education Office of all the districts of the country once at the end of each academic session. The overall performance of the students in this examination is found to be directly affected by the performance of the students in mathematics. Inside mathematics also, there are some such units which are directly responsible for the failure of the students in mathematics.

Thus, this study is focused on finding such units in mathematics, which are putting the positive as well as negative effects in the achievement of mathematics. In this chapter, it is tried to give the background of the study, the problem focused by the study, the significance and objectives of the study, research questions, and hypothesis.

1.1 Background of the Study

Mathematics, the science of all sciences, is one of the significant disciplines ever realized not only from the academic perspective but also from the behavioural point of view. Its correlation with various fields of study and its application in every walk of human being definitely makes mathematics an inevitable thus inseparable component of human life. Moreover, the strength of a nation lies in its commitment and capacity to prepare its people for needs, aspirations and requirements of a progressive technological society framed well by mathematics. In this regard, it is necessary to prepare the child of this ever challenging era of technology with a strong foundation of mathematics.

Etymologically mathematics is derived from two Greek words **Manthanein** means learning and **Techne** means art. So, mathematics is the art of learning. This etymological meaning of mathematics even signifies that mathematics is the key to all sciences. Realizing the importance of mathematics, it has been accepted as a fundamental component of formal education from ancient period to the present day all over the world. In the pre-historical period people, knowingly or unknowingly, were obliged to use mathematics while solving their day to day problems. Later on advanced form of mathematics structure, rules, formulae, theories have been developed and used on solving social problems through empirical observations and experiences. But at present, every human discipline is interpreted in mathematical models. Therefore, there is a definite need of mathematics in the daily life of every individual and also for the further studies.

"Ever since the school of an ancient Greeks over the past 2000 years, mathematics has been a key subject in the curriculum. The four liberal arts, the quadrivium consists of Arithmetic, Geometry, Astronomy and Music, were basically mathematical studies." - (Traverse and others 1977)

The importance of mathematics as realized by the ancient people is apparent in the above lines abstracted from Traverse. Out of the four liberal arts of the time two are strictly the mathematical core subjects whereas the other two are also the subjects of the strong mathematical foundations. Thus, it can be praiseworthy to claim that mathematics is the subject of great importance and directly related to the human activities and so mathematics has an abundant and relevant historical background. One can not go beyond mathematics in the course of the study of any discipline of the time. One must have a mathematical view well shaped by logic to enter the universe of learning.

"Mathematics is around us. So are the opportunities to make math come alive for our children. We should work with our children to be sure that they develop a comfortable relationship with numbers. This involves the child not only acquiring basic math skills, but even more importantly, understanding how to use them." - (Jones 1988)

Jones is entirely optimistic towards mathematics and believes that mathematics is the only way to have greater success in the life. Therefore, the situation for children to learning mathematics should be lifelike. The children should take mathematics comfortably to acquire the basic skills and later should be able to use them in the necessary context. This logic again reveals the necessity of mathematics to some extent.

From the evidence of the origin of mathematics through human efforts concerning to needs and the application of mathematics at present we conclude that mathematics is the essential part of human civilization. From an

ordinary rickshaw puller to the leading Prime Minister of the country, mathematics is serving so accurately, so honestly and so impartially. Thus, the history of mathematics is a part of the history of human civilization.

“Mathematical reasoning sharpens the mind, actually it has pushed and pushing forward the frontiers of scientific and technical knowledge, discoveries and innovations, for all these reasons, it occupies a well established position in the school of all countries. ” – Datta and Singh (1962)

The value of mathematics and its role in the overall learning process, above all its support on the scientific and technological fields, so called backbone of the civilization are all highly focused in the above abstracts from Datta and Singh. All discoveries and the innovations are due to mathematical reasoning and thus, mathematics should be given the suitable place in the school curriculum and so is done almost all over the world.

Regarding the function of mathematics Wood (1960) writes – “The function of mathematics is to help pupils at each level, make better adjustment to social surroundings and relationship in their own every day life. ” Three major focuses on function of mathematics according to Wood are the role of mathematics in the advancement on the learning of the other subjects, the role of mathematics in the social adjustment of the children and the role of mathematics in the everyday life.

Regarding the implication of mathematics Cockcroft (1983) says – “For many it is seen in terms of arithmetic skills which are needed for the use at home or in the office or workshop. On the basis of scientific development and modern technology, some emphasized the increasing use of mathematical techniques as management tool in commerce and industries.” This proves that mathematics is such subject which has the equal value for all categories of people though; they are being benefited by mathematics in different levels at different ways.

Adhar Siksha (1947) in Nepal has given mathematics a significant place in the history of school curriculum. In 1950, two types of mathematical syllabi were designed for boys and girls. Out of 800 full marks, mathematics of 100 or arithmetic of 50 full marks was compulsory and additional mathematics of 100 full marks was optional for male students, but only optional mathematics of 100 full marks was prescribed for female students.

Nepal National Education Planning Commission (NNEPC - 2011) reported that compulsory mathematics was in the curriculum of multipurpose secondary school. Advanced mathematics was also included in the college preparatory area of the vocational works.

All Round National Education Committee (ARNEC - 2018) had recommended to include compulsory mathematics as well as optional mathematics in arts and science school but only one mathematics was optional in vocational and Sanskrit Schools. ARNEC had set the pass marks 40% of the total full marks.

After the implementation of National Education System Plan (NESP) in 2028, the school curriculum was refined and a total change was made. As stated in the NESP - "A well ground understanding of mathematics is essential for everyday life as well as for higher study in the field of science and technology. Mathematics, like language, is a basic tool of communication, daily transactions and communications involve the frequent use of mathematical concept. Thus it is quite natural that mathematics be given a very important place, second to language in school education. Students apply mathematical concepts, skills and logical reasoning to solve different kinds of problems not only as students but also as adults later on."

As per the recommendations of NESP mathematics was given the significant place in the school curriculum of Nepal. Out of the total time for instruction of

the school, 30 percent was allotted for mathematics in the primary level, 20 percent was allotted in the lower secondary level and 12 percent was allotted for the compulsory mathematics in the secondary level. Pass marks of mathematics was determined 32 percent of the total value of mathematics. After the reformation in curriculum as suggested by National Education Commission 2049 B.S. 18 percent time was allotted for mathematics in the primary level, 15 percent in the lower secondary level and 12 percent in the secondary level.

The students' achievement in mathematics, on comparison of the time allotted for mathematics in the school, is not satisfactory in the history of Nepalese formal education. Various results of standardized tests and the researches over them show that mathematics is the subject in which occurs the greater number of failed students. There may be different causes for this failure such as the prescribed teaching hours may not be sufficient, appropriate teaching methodology would not have been adopted, lack of motivation, students' indifference of the value of mathematics, false techniques in the measurement and evaluation of the students etc. Almost all research findings shown that there is not a unique determinant which affects pupils' achievement, but it is widely accepted that there may be many different factors which are related to mathematics achievement. Some factors or variables such as students' gender, age, parents education, location of the school, prior knowledge, motivation, family environment, teachers' academic certification, teaching skills, availability of learning materials. medium of instruction, class size, socio-economic level of the community, absence or irregularity of the teacher in school, low class attendance of the students, genetic factors etc affect negatively for the achievement of mathematics in our context. So, they must be controlled.

The failure rate of the students in mathematics is higher on comparison of the other subjects almost in all the levels in Nepalese context. The students'

achievement in the district level examination of class VIII is also not beyond the overall result of mathematics. One of the main causes of this failure rate in the district level examination in mathematics is due to the presence of some difficult units in the prescribed mathematics curriculum for the particular class. Many researchers have studied about the comparative study of achievement in mathematics of school level regarding the myriad input variable. But comparison between topic wise achievement and difficulty level of units prescribed in the content has not been studied and detected yet regarding the students performance in district level examination of class VIII. Therefore, it is customary to identify such units of mathematics from which large number of students could not solve the questions and those lead the average level students to their failure.

Present mathematics curriculum of class VIII was implemented since 2055 according to the recommendations of NEC (2049). The syllabus consists of different topics such as Set, Number system, Arithmetic, Algebra, Geometry, Mensuration, Transformation, Bearing & Scale Drawing and Statistics. Studies about the difficulties of all these related units of this content has not been carried out yet to identify whether all these units have proportional influence in the higher failure rate of the students in mathematics or there are particular units which play significant role. Thus, the present research proposal merely guided towards the investigation of the major units responsible for causing the higher failure rate of students in mathematics in the district level examination of class VIII.

1.2 Statement of the Problem

Among various standardised tests, District level examination of class VIII is one, which is administered and monitored by DEO and is also considered as the mini SLC examination. Thus, its significance and value can not be discarded in our context. Moreover, the curriculum of class VIII is so designed that the same can be a strong foundation for the secondary school

mathematics. Regarding this point of view, the achievement of the students in mathematics in this examination forecasts the mathematical future of the students. Thus, an appropriate time value to reach the teaching learning activities to a meaningful end, the governmental investment in terms of financial aid, and parental investment are all highly focusing on it. Even the students are, to some extent, doing their best so as to achieve better in the so called mini SLC exam. Besides these, what the results of the district level examinations show, is not satisfactory on comparison of the efforts on it from all sides. The results in public and community schools are still worse than those in the private and institutional schools. There are definitely, some causes which are responsible for the unsuccessful endeavour of the process. One of the main causes behind this may be the inclusion of some awkward, insignificant and inappropriate above all difficult units in the syllabus. So, this research is expected to unfold the problems in this periphery and to compare the inter-topic difficulty of the existing curriculum of the particular class because the study of the topic wise achievement of the students in this sort of examinations has not yet been detected.

1.3 Rationale of the Study

There are various hidden facts in every field of the study and several attempts are made to reveal those facts. If a research work tries to reveal more than one hidden facts, the level of significance of the work will be questioned and the whole research work becomes chaotic. So, every good research has its own importance within it because it manifests various unseen facts related to the particular area of the study. This study basically has tried to find out if there is relevant proportional variation in unit wise achievement in mathematics of class VIII or all the units are equally responsible regarding the difficulty level, for the higher failure of the students in the district level examination of class VIII. The results and findings of this research is hoped to help all the mathematics teacher of the particular class to prepare their students so that the achievement in mathematics in future will be comparatively better. The

identification of the difficulty areas will provide the teachers a true guideline for their classroom teaching. This study will also provide a type of view to the curriculum designer to rethink, redesign and reform the course contents and the evaluation tools for the present class VIII mathematics curriculum. The study is hoped equally to provide all the target students a type of prior knowledge of the different units which later helps them for their self study and definitely motivates them in their study.

The general significances of this study are as follow:

- ❖ It provides information to the concerned persons, agencies and government about the unit-wise achievement rate in different units related to mathematics contents of the Lower Secondary Level.
- ❖ It helps concerned agencies and persons to reform the content and teaching hour, especially for those units which lead the students to high failure.

1.4 Research Questions

Right after the restoration of democracy in the nation in the year 2047 B.S. the government restructured the school level education. The three level of school were then changed to four. The top class of the lower secondary level before 2047 was class 7 but the education act included class 8 in the level and decided to conduct the district level examination of class 8. Over the past 15 years we experienced the district level examination but no study was made to identify the hidden facts related to the examination. Basically, in mathematics we could find rare cases. With an intention of finding the chapters included in class 8 mathematics syllabus, which are responsible for the high failure rate in mathematics in the district level examination of class VIII, the present study is made.

The major concern of the study is to find the unit wise achievement level of the students in mathematics in the district level examination of class VIII. A

large number of failed students in mathematics are in fact the victims of the inclusion of some difficult units in the syllabus and the inappropriate dealing with those chapters by both the teachers and the students. Thus, the study is intended to answer the following research questions:

- ❖ Do all the units of mathematics proportionally influence the students' success in mathematics in district level examination?
- ❖ Is the failure rate of the examinees in each unit of present mathematics of class VIII equal?

1.5 Objectives of the Study

The study is intended to meet the following specific objectives:

- ❖ To examine the failure rate in different units in present mathematics contents of class VIII.
- ❖ To identify the major difficult areas in mathematics for the average students.

1.6 Statements of the Statistical Hypothesis

- ❖ *Null Hypothesis (H_0):* There is no significant difference between proportions of failure students in different units.
- ❖ *Alternative Hypothesis (H_1):* There is significant difference between proportions of failure students in different units.

1.7 Delimitation of the Study

It is the reality that the students all over the world are taking mathematics as one of the most difficult subject. The condition is higher in case of developing countries like Nepal. In this regard, the concerned matter of the study is a serious national problem and so it is customary to bring a nationwide research regarding this issue. But there are some factors directly influencing the research process such as time and cost are the dominating ones. Thus, the study has the following limitations:

- a) This study is focused only to examine the difficult areas of class VIII mathematics i.e. the achievement of students in mathematics of a particular class not all the students studying mathematics.
- b) This study compares unit wise achievement of the students in the examinations.
- c) This study does not have any concern about the suitability of question model according to the specification grid of class 8 and does not say anything about managerial functions such as planning, organizing, leading and controlling of the examination system.
- d) The study is limited to Lekhnath municipality area of Kaski district and the main source of the study is the students' performance in the pilot test and the achievement test conducted by the researcher in the sample schools.

1.8 Definition of the Terms

District Level Examination: The annual examination of class VIII monitored by District Education Office at the end of the academic session. This exam is often called the final examination of the Lower Secondary education.

SLC: A national level examination monitored by the Office of the Controller of the Examinations (Ministry of Education). This examination is for those who have completed their secondary level education as the recommendation for the further study.

Achievement: The score obtained by the students in the different examinations is here considered as the achievement.

Pilot Test: The test conducted by the researcher so as to test the difficult level, discrimination index, reliability and validity of the test items

Institutional School: The school without any aid from the government and run by private investment by individual or union, agencies and any particular group as company or trust. (Education Act 2028, 7th amendments)

Community School: The school that is established and sponsored by the government (Education Act 2028, 7th amendment)

CHAPTER - II

REVIEW OF RELATED LITERATURE

Sufficient literature related to the model of this research in the Nepalese context could not be found. Such a study, so far as the researcher's perception is concerned, has not yet been carried out. National and international agencies concerning to school and universities has not attempted to compare the unit wise achievement of the students in different units of prescribed contents. Nevertheless, few related materials are used and they helped to make the concept clear for the study. It is hoped that they will help to analyze and interpret the data in the course of the research.

'School-Related Influences on Grade VIII Mathematics Performance in Massachusetts' (2005), a study made by Bradley and Warren is found significant to give some concept to the present study. The study demonstrates that it is possible to increase the mathematics achievement of very large classes of low-income (and mostly below-grade) students dramatically without grouping. The study concluded that algebra in the grade VIII is the gateway of the courses for more advanced mathematics and science courses in all the years of the school education.

'The Second International Mathematic Study' by White and Dossey (1981/82) in USA, was done for the grade eight students and teachers of approximately 500 classroom in about 250 schools. The classrooms were selected through stratified random sampling regarding the curriculum of grade eight. The study was highly focused in arithmetic rather than algebra and geometry and given more emphasis for to find the mental mathematical concepts and perception of the students. But this study shows that the achievement of the students in arithmetic was not satisfactory.

Pandey (1999) in his '*Comparative study of teaching activities and achievement in mathematics of pupils of private and public schools in lower secondary level at Birendranagar Municipality*', found that the activity ratio and achievement rate of students in mathematics of private school was found higher than the achievement of the pupils of the public schools. He also found in the area of algebra and arithmetic private school students achieved higher marks but in geometry both schooling made their children perform equally.

Regarding the developmental differences in mathematics, a comparative study of difficulties in different areas in school mathematics was made by Eline Reikers (University College, Stavanger - 2003). All the students involved in the sample were divided into four groups: (MD/RD), those who have difficulties in both mathematics and reading, (MD-only), those who have difficulties in mathematics but not in reading, (RD-only), those who have difficulties in reading but not in mathematics and (Neither MD nor RD), those who do not have difficulties in any of the two. Both cross sectional and longitudinal methods have been applied and longitudinal analysis is still going on. For the cross sectional analysis both multivariate and univariate analysis of variance MANOVA and ANOVA were applied. The result of the analysis of the cross sectional study shows that the latter group among the above mentioned have pervasive difficulties in mathematical thinking while children in the former group have more difficulties in mathematical achievement.

Panthi (2000) in his thesis submitted to TU entitled '*A comparative study of Achievement in Geometry of Eight Graders in Lamjung District*' provided the achievement patterns in geometry. The study was mainly focused to make the comparison of mathematical achievements on the basis of gender and the spatial factor i.e. urban area versus rural area. He concluded that the students studying in urban areas have better performances in geometry. His findings also indicate that boys perform better than girls in geometry.

Dhital (2000) carried out a research through his thesis paper submitted to TU entitled 'Analysis of Mathematics Contents of Grade VIII' to investigate the appropriateness of contents, examples and exercises of the text in order to acquire the required learning outcomes. By the stratified random sampling, he had selected forty school teachers and developed a questionnaire and used t-test and concluded that the binary number system, percentage, profit and loss, simple interest, statistics, factorization and other topics of algebra were appropriate to achieve the expected learning outcomes but the contents like geometry and mensuration are those from which the expected learning outcomes are not met.

CHAPTER - III

METHODOLOGY

This study is basically an investigation of the achievement rate of the students in different topics prescribed in the mathematics curriculum of grade VIII. The study is designed to identify the difficult topics, from which the average level students could not score the marks. Mathematics scores of 80 students of Kaski district in the achievement Test which was equivalent to District Level examination have been analyzed and the results are interpreted. Besides this, a questionnaire, regarding the performance of the students, is developed for the teachers who were involved in the correction of the mathematics answer papers of the district level examination of class VIII.

To organize the study in suitable and meaningful model, this chapter is divided into sub topics such as research design, population of the study, the sample of the study, tools of the research, data collection procedure and the data analyze process.

3.1 Research Design

As this study intends to find the units which are responsible for the failure of students in the district level examination of class VIII, the study strictly follows the descriptive research procedure. Moreover, the study is normative and quantitative in nature to some extent. For the quantification procedure the design uses ratio scale also. The unit wise proportions are compared and hypothesis is tested.

3.2 Population of the Study

The present research is hoped to be useful to all the concerned. The findings not only help the teachers in determining the units to be focused from the teacher's side but also be fruitful to the students of the particular class while having the self preparation; they can give more emphasis on such topics. Thus,

all the students of class VIII, after the implementation of the present new syllabus, of all private, public and community schools of Nepal, are considered as the population of this study.

3.3 Sample of the study

The sampling strategy for choosing schools for inclusion in the study required partitioning the universe of the schools of Nepal. First, schools were considered only if they administered the District Level Examination every year of the study period and administered it to a minimum of 16 students. All public, private and institutional schools are required to administer the examination with no exception. Altogether 33 schools in Lekhnath met these criteria as of the academic year 2065. Next, in order to capture the effects of a school being part of a large or a small ward (area) were classified according to their size. Wards with fewer than two schools giving the mathematics test in 2065 were classified as small wards. All other school wards were classified as large.

Inclusion in the sample was based on performance on the district's mathematics test. Schools were first partitioned into two groups based on whether their observed change was above or below the districts average increase in the percent testing at the two highest levels. The district average change was calculated as the mean of the changes in all 33 schools in the sampling frame. A second partition was based on a greater or less than average decrease in the percent of a school's students at the lowest level on the district's mathematics test, creating four groups in all. The group of interest in the study represented schools that had both increased the percent of students testing at the two highest levels by more than the district's average and simultaneously decreased the percent of students at the lowest level by more than the district's average over the study period.

Stratified random sampling procedure was performed to select schools in the sample. Three schools in the sample were selected randomly on the basis of geographical location. In this regards, a school from each area; rural, semi urban and urban, is selected. Two other schools in the sample were selected by observing the overall success rate of the students in the district level examination of the year 2065 B.S. One is the school with the highest pass percentage and the other with the lowest pass percent of those schools except the previously selected three.

By adopting the stated sampling strategy, 80 students from five different schools of Lekhnath Municipality of Kaski district, were taken in the sample of the research. For selecting the students in the sample, the total number of students in each school was divided by 16 and the students were selected from the register at the interval of the quotient obtained by that division. In every school the first selection is the student with roll number 1. Besides this, 15 teachers who involved in checking the answer sheets of mathematics in the district level examination of 2064 were also included in the sample. The following table reveals the details of the sample schools.

Table - 1
Number of students in the sample

| S.N | Name of the school | No. of boys | No. of girls | Total |
|-------|---|-------------|--------------|-------|
| 1 | Laxmi Adarsha Higher Secondary School, Shishuwa | 8 | 8 | 16 |
| 2 | Janaprakash Higher Secondary School, Bhandardhik | 9 | 7 | 16 |
| 3 | Amar Siddha Namoon Ma. Vi., Pachavaiya | 10 | 6 | 16 |
| 4 | Laxmi Ma. Vi., Argahaun | 8 | 8 | 16 |
| 5 | Bhawani Kalika Higher Secondary School, Bijayapur | 7 | 9 | 16 |
| Total | | 42 | 38 | 80 |

3.4 Tools

The test papers of the students in different internal examinations, the answer sheets of district level examinations, the scores of the pilot test and achievement test, the model questions, the mathematics curriculum of the particular class, and the latest specification grid were the major tools for the present research. The researcher himself is a mathematics teacher, and thus he consulted the members of district examination committee and those of the resource centres, constructed the test papers using based on the newly framed specification grid of class VIII. The test paper so constructed was used in the pilot test which was conducted at one of the schools in the same population size but not taken in the sample. The pilot test scores were analyzed so as to refine the final test. The final test question paper was constructed and the achievement test was conducted in five sample schools. The test paper consists of 8 very short questions of 1 mark each, 14 short questions of 2 marks each and 17 long questions of 4 marks each. The learning outcomes according to the specification grid were targeted to meet the parameters of cognitive domain: knowledge, understanding, skill and problem solving level. The specification grid restructured in 2061 is presented in appendix – I

The sequential arrangement of the test items in the district level examination of class VIII is as below:

Group 'A'

1. a) Set – Relation of sets
b) Set – Subset, cardinality of set
2. a) Ratio and Proportion – basic concept of ratio and proportion
b) Percentage and Simple Interest – relation of the terms I, P, T and R
3. a) Algebraic Expression – HCF and LCM of simple algebraic expression
b) Equation, Graph and Inequalities – Slope and intercept of a linear equation

4. a) Lines and angles – Simple problem on the relation of the pair of angles
- b) Bearing and scale drawing – Simple problem on bearing angle

Group 'B'

5. a) Set – problem related to the simple operation on sets (union and intersection of two sets)
- b) Set – problem related to the simple operation on sets (difference and complement of sets)
6. a) Number system – problem related to the rationalization of surds
- b) Fraction and Decimal – rounding off and significant digit
7. Statistics – simple problem on calculation on measure of central tendency particularly that of an individual observation
8. a) Algebraic Expression – Simplification of simple algebraic rational expression
- b) Algebraic Expression – Laws of indices
- c) Algebraic Expression – Factorization of algebraic expression of the form $ax + bx + cx$, $ax + ay + bx + by$, $a^2 - b^2$, $ax^2 + bx + c$
- d) Equation, Graph and Inequalities– slope of the linear equation of the form $ax + by + c = 0$
- e) Equation, Graph and Inequalities – Graph of simple linear inequality of single variable
- f) Equation, Graph and Inequalities – Simple problem on quadratic equation of the form $ax^2 + bx = 0$, $ax^2 - b = 0$
9. a) Lines and Angles – problem related to the angles associated with the parallel lines
- b) Triangle – problem related to the properties of triangle or application of Pythagoras Theorem
- c) Quadrilateral and other polygons – problem related to the properties of quadrilateral or interior and exterior angle of regular polygons

- d) Similarity and Congruence of Triangles – problem related to the properties of congruent triangles or the condition for triangle to be congruent
- e) Similarity and Congruence of Triangles – problem related to the properties of similar triangles or the conditions of triangles to be similar
- f) Perimeter, Area and Volume – Area of quadrilateral, area and circumference of circle,

Group 'C'

- 10. Set – problem related to the Venn diagram showing the relation of three sets including the operation on sets
- 11. Number system – addition and subtraction of numerals in the bases other than 10
- 12. Percentage and Simple interest – problem related to the percentage increase or decrease in population or any other value – problem related to the simple interest
- 13. Profit, Loss, Discount, Taxation and Commission – problem related to any one or two of the five topics mentioned
- 14. Statistics – Problem related to the calculation of mean or median from the discrete or continuous series
- 15. Statistics – Graphical presentation of data / pie chart
- 16. Algebraic Expression – problem related to the laws of indices
- 17. Algebraic Expression – problem related to the HCF and LCM of algebraic expression
- 18. Algebraic Expression – problem related to the simplification of the rational algebraic fractions
- 19. Equation, Graph and Inequality – verbal problem related to the equation or inequality
- 20. Construction – construction of triangle or quadrilateral with the given dimensions

21. Triangles – problem related to the experimental verification of the properties of triangle
22. Area and Volume – problem related to the surface area and volume of cube, cuboids, cylinder or triangular prism
23. Transformations – problem related to the simple reflection and rotation of the geometric figures using the graph

Test paper was constructed by the researcher for the pilot test examination according to the above model. The selection of the test items is so structured that it is most likely similar to the questions asked in the district level examination. The difficulty level of the questions is also well considered while setting the questions. For the standardization of the test, a pilot test was administered among 21 students of Gogan Ma Vi, Gagangaunda, Kaski before the application of the test in all the sample schools.

3.5 Item Analysis

For to ensure the reliability and validity of the pre district level examination of the sample schools a pilot test was administered in Gogan Ma Vi, Gagangauanda of Kaski district. The pilot test was subjected to all 21 students of the school. The purpose of the test was nothing other than to get acquainted to the business of test administration. The researcher guided the students well about the structure of the specification grid of the district level examination before conducting the test. The duration of the examination was 3 hours as per the specification grid. The test was conducted in the standard level, the morale of the examinees was well captured and the environment of the examination was tried to make normal so that the students not only treat the test seriously but also feel free to show their talent.

After the administration of the test, an item analysis was made. Difficulty level and the discrimination index of each test items were calculated based on the 27 percent of higher scores and 27 percent of the lower scores. According

to the objectives of the test, the very short questions of 1 mark each are to ask a single phenomenon. Thus, to analyze the items carrying 1 mark, the item was considered as the minimum unit for the correct response and taken as a whole score; for the incorrect response the whole is collapsed (no score), while the items carrying 2 marks were analyzed by using the method of splitting into two halves and the items carrying 4 marks were analyzed by using the method of split-quarter approach. The step-wise evaluation was carried out for the short and long answer questions using the self made marking scheme and the scores were awarded accordingly for the partially correct responses as well. The details of item analysis are shown in appendix - 3.

The researcher is conscious enough about the psychology of test and so, the discrimination indices and difficulty level of items were well judged for to select the items for the final test. The difficulty level is defined as the percentage of students able to solve each item. It takes the interval of the range from zero to hundred percent. The difficulty level and the discrimination indices are calculated by using the formulae given in appendix - 8.

Reliability is the other parameter to measure the standardization of every test. Thus, to ensure the reliability of the test, reliability co-efficient of pilot test was computed by applying split-half methods. For this, the total scores of each student were divided into scores awarded to the correct responses of odd and even question numbers. The split-half reliability calculation table is as shown below.

Table - 2
Reliability Calculation Table

| Student | Marks Awarded for Odd Items | Mark Awarded for Even Items | Total Mark |
|---------|-----------------------------|-----------------------------|------------|
| A | 48 | 43 | 91 |
| B | 43 | 42 | 85 |
| C | 35 | 43 | 78 |
| D | 39 | 38 | 77 |
| E | 31 | 34 | 65 |
| F | 32 | 28 | 60 |
| G | 27 | 31 | 58 |
| H | 27 | 29 | 56 |
| I | 29 | 20 | 49 |
| J | 23 | 23 | 46 |
| K | 19 | 25 | 44 |
| L | 21 | 17 | 38 |
| M | 18 | 17 | 35 |
| N | 19 | 16 | 35 |
| O | 18 | 14 | 32 |
| P | 13 | 14 | 27 |
| Q | 18 | 9 | 27 |
| R | 13 | 10 | 23 |
| S | 7 | 11 | 18 |
| T | 8 | 7 | 15 |
| U | 7 | 7 | 14 |

In table-2 the students appearing the pilot test are denoted by the alphabets in the first column, the total marks scored for the odd question numbers are presented in the second column while those scored for the even ones are presented in the third column and the total score in the fourth column.

For the analysis of data, the standard deviation of the total scores, scores for odds and those for evens are calculated and are found as below:

$$\text{SD of total scores (sd}_t\text{)} = 23.30$$

$$\text{SD of scores awarded for odds (sd}_o\text{)} = 11.57$$

SD of scores awarded for evens (sd_e) = 12.14

The reliability co-efficient (r) is calculated by using Flanagan's formula and has found to be 0.96. The test is further refined by accepting, rejecting and modifying the necessary items. Table - 3 tells the details applied by the researcher to select the test items for the final pre district level examination on the basis of the pilot test result and the reliability test.

Table - 3
Criteria of Item Analysis on the Basis of Difficulty Level and Discrimination Index

| Criteria | | Item Evaluation | No. of Items | Remarks |
|---------------|---------------|-----------------|--------------|---|
| P-Level | D-Level | | | |
| Above 80% | Negative | Very Easy | 0 | No item rejected for this reason |
| 35%-80% | 0.2 and above | Good | 33 | Accepted |
| 20%-35% | 0.2 and above | Difficult | 5 | Need modification: [Items 6(a), 11, 12, 22, 23] |
| Less than 20% | Less than 0.2 | Very Difficult | 2 | Rejected: [Items 8(e), 13] |

Criteria used as suggested by Fisher

In the above table it is shown that the items with P-value greater than 80%, which are very easy from the psychological perspective of the evaluation and those with P-value less than 20 or the very difficult items, were both rejected. Similarly, the test items with D-value less than 0.2 and with negative D-value were also rejected. Thus, the items that meet the above criteria i.e. item No. 8(e) and 13 were entirely removed and replaced. The items with P-value ranging from 20% to 35% are considered as the difficult questions and are modified. Such, items in the pilot test are item No. 6(a), 11, 12, 22 and 23. The items with P-value between 35% and 80% and D-value greater than 0.2, are considered as the good test items. Thus the final test questionnaire have been constructed by modifying and changing the necessary questions and the question set has again met the specification grid (Appendix-1) issued by the CDC.

The researcher on the other hand had prepared a closed type questionnaire to investigate the natural existence of difficulties of each topic. The questionnaire was focused to collect the views of sample teachers. The respondent teachers were suggested to write the names of the units or topics in hierarchical order on the basis of not attempted or wrongly attempted questions in the District level examination. The questionnaire contains seven different questions asking to list the name of units in which knowledge and understanding was found weak, difficult problems were solved but simple problems were not solved, different types of mistakes and errors were done, computational skill was wrong etc. The respondent teachers were also requested to write the name of units which has been influencing in the failure of the average level students of the public and community schools. The sets of questionnaire asked to sample teachers are given in the appendix – 5.

3.6 Data Collection Procedure

For the collection of data the researcher consulted the schools mentioned in the sample above and obtained answer papers from those schools for obtaining the necessary information. The researcher collected the answer papers of the final achievement test which was conducted for the students who appeared the district level examination of the year 2065 and presently studying in class IX from all the sample schools. The test was conducted using the questionnaire prepared by the researcher after the modification and changing of some items as suggested by the item analysis in the pilot test.

Besides this the researcher also applied the supplemental data collection instruments which were developed for the mathematics teachers. The researcher visited the sample teachers to fill the questionnaire prepared for them. The teachers selected in the sample were those who involved in the examining the answer papers of the district level examination. The researcher also made the direct personal interview and tried to get the views of the teachers about the underlying difficulty in the mathematics text book, its

significance with the mathematics curriculum and how far the particular mathematics curriculum is serving to meet the national goal of mathematics. The questionnaire contained seven open type of questions in which the teachers were asked to mention the units in which the students did not even try to attempt and were solved by very few number of students etc. The survey data collection instruments were administered by personal contact to 15 teachers.

3.7 Data Analysis Process

For the statistical analysis of data related to the scores secured by the sample students, a non-parametric test was used. For this purpose, the scores obtained by the students in different units were categorized into three viz: the ones securing less than 30% of the total mark named as **WARNING GROUP**, the second group consists of those securing the marks from 30% to 60% named as **PROFICIENT GROUP** and the third of those securing the marks more than 60% named as **ADVANCED GROUP**. The number of fail students in each unit were recorded and then the equality of proportion of unit wise fail rate of the students in each of the three groups, were tested by using a χ^2 (chi-square) – test.

There were seven questions in the questionnaire prepared for the teachers; each question asking to mention the names of the five prominently responsible units in hierarchical order. The questions sought to find the strength of knowledge and understanding level of the students in the particular units; from which units the complex questions were comparatively solved better than the simple; in which units the students are committing very silly mistakes; where the students are not applying the appropriate formulae; where the students computational skills are poor; where the students have good start and finish but they are doing mistakes in the midway of the solutions etc.

To analyze the data received from the respondent teachers the researcher tabulated the responses so as to ease interpretation. The equality of influencing rate of each unit for the examinees to fail in the district level exams has been investigated by comparison of responses of those teachers. On the basis of these responses of the teachers, the difficult units from the perspective of the students, which are responsible for the failure of the students in the district level examination of class VIII, have been interpreted.

CHAPTER - IV

ANALYSIS AND INTERPRETATION

In this chapter, the researcher tried to analyse and interpret the data related to the scores secured by the sample students in the final achievement test. The assembled data of the number of students based on unit wise scores obtained by them are classified into three groups. The first group covers the students who obtain 60% or more scores in the particular unit. This group can be considered as the group of **ADVANCED** students. The second group covers the students securing the marks in the range 30% - 60% and this group can be considered as the group of **PROFICIENT** students. A third group consists of those securing less than 30% score in the unit and the group is considered as a group of **WARNING** students.

“The study of students’ performance in different units is an example of hierarchical structured data which occurs when repeated measurements over time are taken from individuals, who are in turn grouped within schools. Such structures are typically strong hierarchies since the variation within students is much smaller than the one between students. Here the repeated measurement within an individual student constitutes one level, among the students constitutes another and a third level constituted by the school. The existence of such data hierarchies is neither accidental nor ignorable. Failure to consider the hierarchical nature of the data leads to unreliable estimation of the effectiveness of school and entire teaching learning process.” - (Bradley and Warren 2005)

Regarding the above quote, the researcher remained aware enough while setting the tools for statistical analysis and interpretation of the data. Three different tables are set for a group each showing the number of students who secure the mark in the range from the particular unit. A chi-square test was used to test the hypothesis for all the groups.

4.1 Comparison of Proportional Distribution on the basis of Unit wise Score

The discrepancy of the students' ratios lying between the groups on the basis of their total scores and the unit wise scores has been tested by applying the χ^2 (chi-square) - test. The test was expected to identify whether or not the students lying in their particular groups are proportionally distributed to all the units. The test was further expected to accomplish whether all the units are equally responsible or equally contributing the students so as to categorize themselves in their respective groups. As mentioned earlier, the students who score less than or equal to 30% marks in total are in the **WARNING** group, those scoring in the range 30% - 60% are in the **PROFICIENT** group and those securing more than or equal to 60% marks are in the **ADVANCED** group. The different tests were conducted within these groups.

4.1.1 Comparison of the distribution of WARNING students in different units

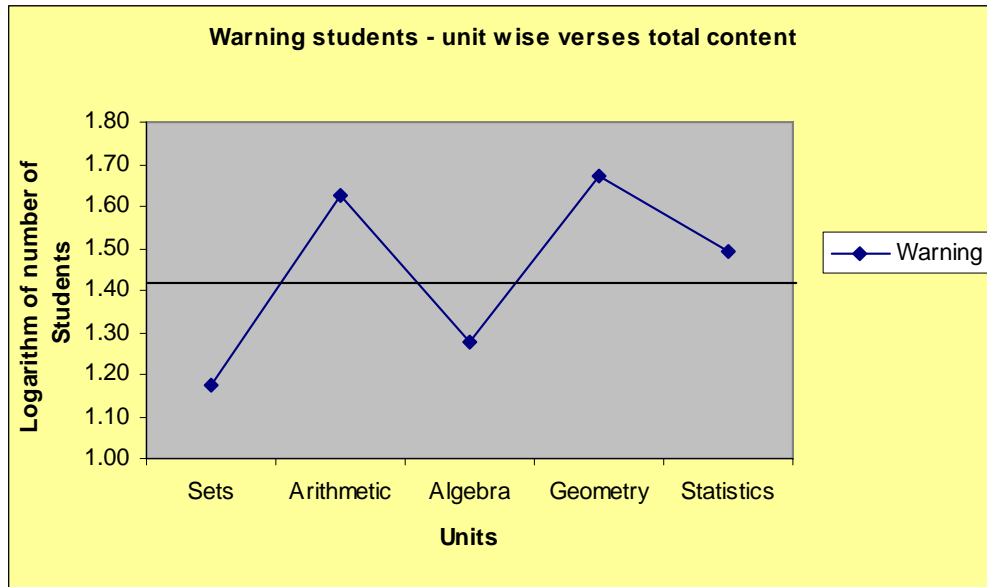
For to study the behaviour of the scores in the **WARNING** group, the researcher tabulated the number of students who secure less than 30% marks in the individual unit and in total as below and used the statistical tool to analyze.

Table - 4
No. of Warning Students in Different Units and in Total

| Units | Sets | Arithmetic | Algebra | Geometry | Statistics | Total |
|------------------------|------|------------|---------|----------|------------|-------|
| No. of Students | 15 | 42 | 19 | 47 | 31 | 26 |
| Log of No. of Students | 1.18 | 1.62 | 1.28 | 1.67 | 1.49 | 1.41 |

Table-4 shows that Sets is the units in which the least number of students fall in the **WARNING** group and Geometry is that in which the greatest number of students lie in the group. If the data is studied in the percentage, 18.8% of the total students fall in the **WARNING** group of this unit, where as 58.8% fall in that group from geometry. As the study is focused on the distribution of the students' ratios, the total number of students who lie in the **WARNING** group from the total contents should not be disregarded. Moreover, that number has the significant role in data analysis. Thus, the total number of students who lie in the group from the total content in the process of calculating the χ^2 value was considered as the expected frequency and the number of students lying in the group from different units as the observed frequencies. By this we get $\chi^2 = 34.31$, but at 0.01 level of significance and degree of freedom 4, the null hypothesis " H_0 : There is no significant difference between proportions of failure students in different units", could not be accepted because the critical region in the condition is $\chi^2_{0.01} = 13.28$. Hence H_0 is rejected and thus it is concluded that the students who obtained less than 30% marks in each units are not proportionally distributed to these units.

Greater number of students is fail in Geometry and Arithmetic than in the other three units. The logarithm of the number of students lying in the warning group from different units ranges by 0.49 which are also significant regarding the distribution of just 1.41 lying in the group from the total content. Comparatively set and algebra are the two units which contribute in excluding the greater number of students from the group. The fifth unit statistics is seemed to be moderate, which is somewhere closer to the total fail percent.



The failure rates of students in the different units and that in the total course have been presented in the above graph, in which the broken line represents the failure rate of the students in the distinct units whereas the straight line is that representing the failure rate in the total course. The graph explicitly shows that the frequencies of the **WARNING** students in the two units Arithmetic and Geometry are above the average fail percentage. The **WARNING** students' performance in Set and Algebra are comparatively satisfactory than those in the other units.

4.1.2 Comparison of distribution of **PROFICIENT** students in different units

The students who secure the marks more than 30% and less than 60% are categorized under the **PROFICIENT** group. The unit wise categorization of the total of 80 students along with the percentage is presented in the table below. The table contains the number of students who secure the marks in this range from the total content as well.

Table - 5

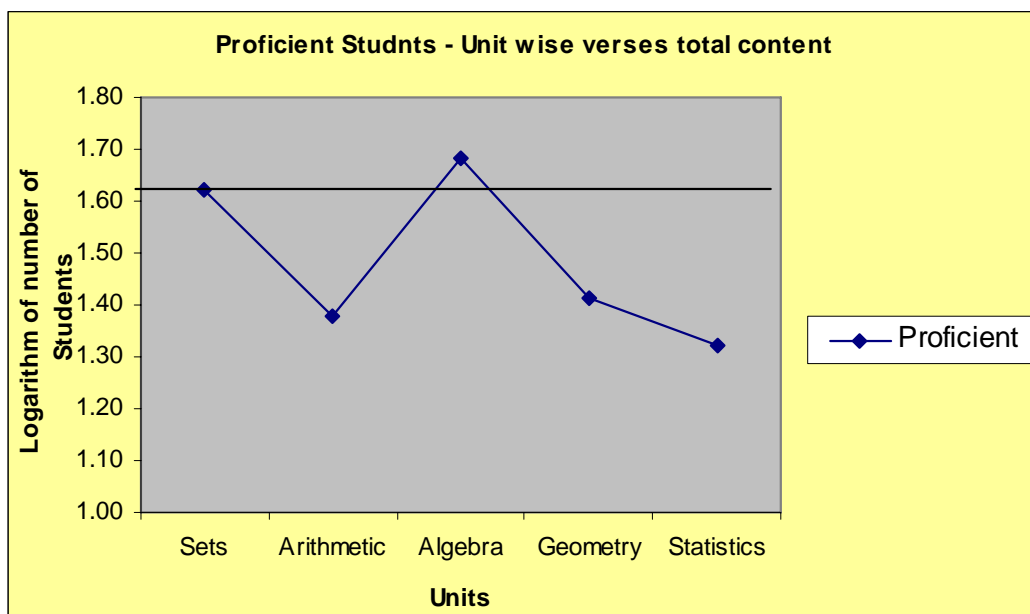
No. of PROFICIENT Students in Different Units and in Total

| Units | Sets | Arithmetic | Algebra | Geometry | Statistics | Total |
|------------------------|------|------------|---------|----------|------------|-------|
| No. of Students | 42 | 24 | 48 | 26 | 21 | 42 |
| Log of No. of students | 1.62 | 1.38 | 1.68 | 1.41 | 1.32 | 1.62 |

Taking the number of **PROFICIENT** students in different units as the observed frequencies and the number of **PROFICIENT** students in total content as the expected frequency, the χ^2 value was calculated and was obtained 25.57. Again for the logical verification of the test, the null hypothesis was tested at 0.01 level of significance and for degree of freedom 4, the critical region 13.28 entirely suggests for rejecting the null hypothesis. Thus it was concluded that the distribution of the students over the different units in the **PROFICIENT** group is not proportional. The logarithm of the number of students in different units shows that most of the students (1.62) are **PROFICIENT** or moderate in algebra whereas least (1.32) are **PROFICIENT** in statistics. Coincidentally, the percent of **PROFICIENT** students in set and those in the total course are same. The data again proved that the two chapters Set and Algebra are those having the important role to pull the students in this group. The other three units apparently seemed to have the greater role in departing the students from the group.

The graph below shows the comparison of the distribution of the students in different units and in the total content. The broken line in the graph shows the percent of students lying in the group from the different units and the straight line shows that in the total course. The nature of these two lines show that there are three units in which the distribution of the students is less than the

number of students from the total course, a unit beyond that and one next coinciding that.



4.1.3 Comparison of distribution of **ADVANCED** students in different units

For the study of the distribution of the **ADVANCED** students in the different units, the numbers of students who secured the marks 60% or more from each individual unit were tabulated. Also the number of students who secured more than 60% in the total course is also mentioned in the same table as below. The distribution percentage of the students ranges from 8.8 to 35 in the following table. 35% of the total students are categorized under this group from this unit whereas only 8.8% of the total students are able to establish themselves under this category.

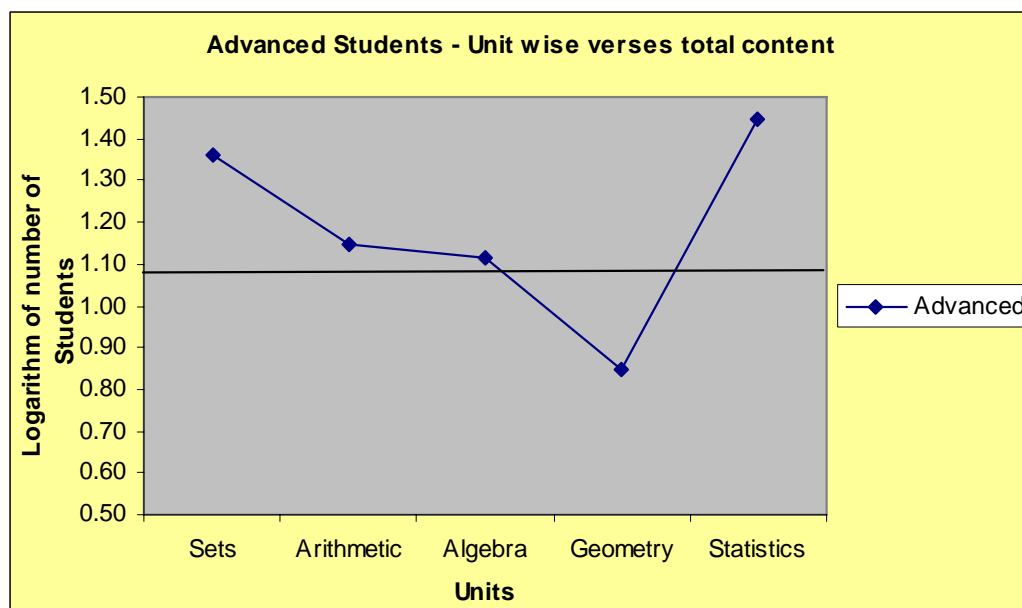
Table - 6

No. of Advanced Students in Different Units and in Total

| Units | Sets | Arithmetic | Algebra | Geometry | Statistics | Total |
|------------------------|------|------------|---------|----------|------------|-------|
| No. of Students | 23 | 14 | 13 | 7 | 28 | 12 |
| Log of No. of Students | 1.36 | 1.15 | 1.11 | 0.85 | 1.45 | 1.08 |

Among 80 students only 12 students were found lying in the advanced level from the total course. This time geometry becomes the one containing the least number of advanced students. And statistics is that containing the maximum number of advanced students. Again the chi-square value is calculated by assuming the number of students securing more than 60% marks in different units as the observed frequencies and the number of students who secure that from the total content as the expected frequency. The chi-square value so found was $\chi^2 = 33.92$. But at 0.01 level of significance and 4 degree of freedom the critical region is 13.28. So, the null hypothesis, " H_0 : There is no significance difference in the ratio of advanced students in different units," is rejected and concluded that the distribution of the **ADVANCED** students over the different units is not proportional.

The diagram below shows the comparison of the distribution of the students in different units and in total. In the diagram, the broken line represents the number of students who secured more than 60% marks in individual units whereas the straight line shows that securing in the total course. The nature of the broken line shows that the distribution of the **ADVANCED** students in different units is not proportional.



4.2 Interpretation of Data Related to Different Types of Weaknesses

To make the study descriptive enough, the researcher had collected the views of teachers who involved directly in examining the answer sheets of mathematics of district examination 2064 of class 8. The responses of the teachers were collected through an open type of questionnaire and by direct personal contact by the researcher. The details of the questionnaire produced for the respondent teachers are presented in appendix - 5. Those sample teachers were requested to write the name of five units in hierarchical order in which the students were making significant mistakes, in which chapters the students left the questions unsolved, in which units the basic expected mathematical skills seemed to be weak, in which units the students were solving the difficult questions but not the simple questions, which units bear the major roles for the failure of the students, in which units the learning outcomes of the students was poor. Such seven questions were raised in the questionnaire and the teachers were asked to mention the names of the five units in the order having the higher role to the lower role for each issue.

To study the nature of the responses of the teachers the data collected were arranged in the tabular form. The table consists of the names of the units in the column heads and the symbols I, II, III, IV and V in the row heads. These symbols represent the order of the roles of particular units for that issue. Right below these symbols, the numbers of responses were sorted.

4.2.1 Responses related to the units in which the questions were not attempted by moderate students

One most traditional and often considered as the powerful tool of evaluation of the system is the study of the in between size or value and interpretation accordingly. As the in between values are statistically closer to the mean than those values at the extremities, it is costmary to study the performances of the moderate students. One other significant cause is that there is a higher interference at the extremities than at the in between. In this regard, the

researcher endeavoured to identify the nature of unit wise dropped questions by the moderate students. The teachers were asked to mention the five units in the order from higher to lower from which the students did not attempt the questions. The result obtained in this regard is shown in the table below.

Table - 7
Number of Respondent Teachers on Dropped Questions in Different Units
by Moderate Students

| Unit \ Order | I | II | III | IV | V |
|--------------|----|----|-----|----|----|
| Set | 0 | 1 | 3 | 6 | 5 |
| Arithmetic | 8 | 3 | 2 | 2 | 0 |
| Algebra | 1 | 2 | 5 | 1 | 6 |
| Geometry | 4 | 6 | 4 | 1 | 0 |
| Statistics | 2 | 3 | 1 | 5 | 4 |
| Total | 15 | 15 | 15 | 15 | 15 |

Subject to the responses received from the teachers who pointed out the name of units related to mostly unsolved or dropped questions by the moderate students, the researcher found that Arithmetic is the unit which the maximum number of teachers i.e. 8 out of 15 kept in number one priority. If the maximum figure in each column is studied, we get 6 keeping Geometry in the number two, 5 kept Algebra in number three, 6 kept Set in number four and 6 kept Algebra in number five. Table - 7, which were constructed on the basis of the responses of the questionnaire attached in appendix - 5, apparently shows that the questions asked from the two units: Arithmetic and Geometry, were dropped by the maximum number of moderate students. Set, Algebra and Statistics are those units in which the moderate students attempted to solve the questions comparatively more than the two units Arithmetic and Geometry. None of the teachers kept Set in the number one order. This also

proves that the moderate students are solving the problems related to this chapter. Only one teacher kept Algebra in first priority whereas none of the teachers kept Arithmetic and Geometry in number five. This again proves that the latter two units are most difficult for the medium proficient students.

4.2.2 Responses related to the units in which the boarder students attempted but not accomplished

The examinees sometimes take some test items for granted and easily conceived as the simpler and attempted to solve with an immediate response but in superficial level. They remain ignorant about the depth of the item. As the result their attempts result in vain. This is experienced by almost all the examinees in a way or the other. The case is most frequent for those students who are at the boarder of pass and fail. Regarding this fact, the researcher developed a questionnaire for the teacher asking to mention the units in order from maximum to minimum, in which the boarder students have attempted the questions but not completed correctly. The responses so found are tabulated in the table below.

Table - 8
Number of Respondent Teachers on Units form which the Students
Attempted but not Accomplished

| Unit \ Order | I | II | III | IV | V |
|--------------|----|----|-----|----|----|
| Set | 1 | 3 | 2 | 5 | 4 |
| Arithmetic | 3 | 5 | 5 | 0 | 2 |
| Algebra | 4 | 3 | 3 | 2 | 3 |
| Geometry | 5 | 3 | 4 | 3 | 0 |
| Statistics | 2 | 1 | 1 | 5 | 6 |
| Total | 15 | 15 | 15 | 15 | 15 |

Out of 15 teachers in the sample only one kept the unit Set in the first order. That is why it can be concluded that the boarder students either did not touch the questions from set or solved correctly. Maximum of 5 teachers kept Geometry at the top level. On this basis it can be concluded that the boarder students thought the questions of geometry easy to solve but they could not solve correctly. This shows that the questions of geometry were puzzling in contrary of the other units for those students who are at the boarder level. Similarly three teachers kept Arithmetic at first order and five kept that at the second order. This again proves that the students were dazzled in the items from Arithmetic. The test items from the Arithmetic seemed to be easy in the eyes of the students but the students ironically were unable to solve the problems. On the other hand the similar condition was not happened in case of Set and Statistics. Six teachers kept Statistics at the fifth order and 5 kept that at the fourth order. This proves that the questions from Statistics were either solved correctly or abandoned entirely. The data received for Algebra looks not helping to distinguish the factor. The teachers were almost evenly distributed to the five orders in Algebra.

4.2.3 Responses related to the units in which the errors made by the students were inconsistent

The similarity in the mistakes made by the students in the same problem gives a type of warning that the item is not suitable or the difficulty level of the item is beyond the acceptable range if a greater number of students are making the same mistake in the same problem. One other but most sensitive cause for students to make similar mistakes in the same problem is the way the teacher interpreted the particular teaching item. Sometimes by one reason or the other, the teacher may misinterpret the teaching item and the students perceived accordingly. This results a serious type of error in the exam by a maximum number of students. Mostly those students who do not have the capacity to their own mathematical reasoning are jeopardized by this practice. There may be a third reason for making the similar mistakes by a maximum

number of student that the particular unit from which the question is selected may not be suitable according to the recognition level of the students.

On the other hand if the mistakes made by the students in the same test item vary, there can be several individual factors within the students. The mere concern comes again connected to the teaching learning situation of the particular learning item. The motivational factor can play a type of role when the students do not concentrate towards what the teacher is teaching, there may be a dissimilar type of errors in the same test response by the students. One next reason for this can be the student's level of interpretation of the subject matter by their won hypotheses. And a third can be the student's physical and mental condition. Sometimes the students with poor hearing capacity can listen something other than what the teacher said as the result they can make error in the exam if the same is asked in the examination.

The researcher in this regard, developed a questionnaire for the teachers who were involved in the checking of the answer sheets of the district level examination of class 8 asking them to mention the units in order from higher to the lower significance, in which the students' mistakes were not consistent. The table below shows the responses of the teachers.

Table - 9

Number of Respondent Teachers on Inconsistency of Mistakes Made by the Students in Different Units

| Unit \ Order | I | II | III | IV | V |
|--------------|----|----|-----|----|----|
| Set | 1 | 1 | 2 | 7 | 4 |
| Arithmetic | 3 | 5 | 4 | 2 | 1 |
| Algebra | 3 | 5 | 3 | 0 | 4 |
| Geometry | 6 | 3 | 4 | 2 | 0 |
| Statistics | 2 | 1 | 2 | 4 | 6 |
| Total | 15 | 15 | 15 | 15 | 15 |

The table shows that maximum of 6 teachers kept Geometry at number one. This shows that the errors committed by the students in Geometry are very dissimilar in type. Similarly five teachers each kept Arithmetic and Algebra at number two. Four teachers each kept Arithmetic and Geometry in number three, 7 teachers kept Set in number four and 6 teachers kept Statistics in number five. This shows that most of the mistakes made in the questions from the two chapters Set and Statistics are of similar types.

4.2.4 Responses related to the units in which the learning achievements of the students are unreliable

Unreliable learning outcome here refers to the unexpected positive or negative achievements on certain learning items. Sometimes a particular learning item is expected to be gained by the group of the higher level achieving students but not by those who are in the level lower than the group. On contrary the result in the examination shows just opposite than what was expected. The questions which were expected to be solved by a greater number of students may not be solved but those which were supposed to be dropped by the greater number of students may be solved. This type of error in forecasting the test results may affect the examination process as the examiner is predetermined for the questions from the particular unit.

For to collect the views of the respondent teacher in this regard the researcher developed a questionnaire asking the teachers to mention the units in order from higher to lower, from which the students are solving the difficult problems but dropping the simple questions. The data so collected is again presented in the tabular form as below.

Table - 10
Number of Respondent Teachers on Units from which the Students' Achievement is not Reliable

| Unit \ Order | I | II | III | IV | V |
|--------------|----|----|-----|----|----|
| Set | 3 | 3 | 3 | 5 | 1 |
| Arithmetic | 2 | 4 | 3 | 2 | 4 |
| Algebra | 5 | 3 | 1 | 3 | 3 |
| Geometry | 3 | 2 | 4 | 3 | 3 |
| Statistics | 2 | 3 | 4 | 2 | 4 |
| Total | 15 | 15 | 15 | 15 | 15 |

The views of teachers on the units in which the learning outcomes of the students are unreliable in the Table - 10 shows that maximum of 5 teachers claimed that the students are solving the unexpected problems from Algebra in number one order. The number of teachers to keep every unit in the first order is not nullified. This type of variation in keeping the units in first position ranges from 2 to 5. Similarly, the maximum of 4 teachers kept Arithmetic in second order, 3 teachers each kept Set, Algebra and Statistics in the second order and only two teachers kept Geometry in that order. When we look the units kept in fourth and fifth order, we find 5 teachers keeping the unit Set in the fourth order as the maximum and 4 teachers each keeping Arithmetic and Statistics at the fifth level. The data shows that the unit Set is the one in which the learning achievement of the students is reliable on comparison of the other units.

4.2.5 Responses related to the units in which the learning outcomes seemed poor

From the psychological perspective teaching is expected to bring a sort of change in the behaviour of the learning. The type of change that a learner

shows after the process is what we call the outcome of the process. Particularly the learning outcomes in mathematics possess the greater significance as it is highly applicable in the other fields of studies. Regarding the aim of teaching mathematics Poincare in his famous book *Science and Method (1908)* says - "The principal aim of mathematical teaching is to develop certain faculties of the mind, and among them intuition is not the least precious. It is through it that the mathematical world remains in contact with the real world." According to Poincare mathematics is the only way that leads an individual to the real universe of learning.

As intuition plays the most important role in learning mathematics, the association of intuition with the learning outcomes in mathematics cannot be discarded. With an intention to measure how far the learning of mathematics by the class 8 students is successful in regards of remaining in contact with the real world in the eyes of the teachers, a questionnaire was developed to collect the views of the teachers regarding the level of learning outcomes acknowledged by the students in different units. The teachers were asked to mention the units in the order from higher to lower, in which the learning outcomes of the students or the role of intuition seemed to be poor. The responses collected from the teachers are tabulated below.

Table - 11
Number of Respondent Teachers on the Units in which the Learning Outcomes seemed poor

| Order Unit | I | II | III | IV | V |
|---------------|----|----|-----|----|----|
| Set | 0 | 1 | 3 | 6 | 5 |
| Arithmetic | 5 | 3 | 4 | 1 | 2 |
| Algebra | 2 | 6 | 3 | 2 | 2 |
| Geometry | 6 | 3 | 3 | 2 | 1 |
| Statistics | 2 | 2 | 2 | 4 | 5 |
| Total | 15 | 15 | 15 | 15 | 15 |

The above table shows that the maximum of six teachers mentioned Geometry at number one. This obviously proves that the learning outcomes on Geometry are comparatively poor than other subjects. Likewise five teachers out of fifteen mentioned Arithmetic in the second order. And thus the similar type of problem occurred in Arithmetic. None of the teachers mentioned Set at the number one order, six kept it at number four and five in number five means the development of intuition in this particular chapter is comparatively better than the other units. As per the teachers views it is also found that the students were showing better interests in Statistics as four teachers mentioned the unit at number four and five in number five. The distribution of the teachers in different orders in the unit Algebra is really inconsistent and irrational. Just two teachers mentioned this unit at first order; meanwhile a maximum of 6 teachers mentioned it in number two, three in number three, two in number four and again two in fifth. This shows that the learning outcomes in Algebra are also not satisfactory.

4.2.6 Responses related to the units in which the mathematical knowledge and skill seemed poor

According to the specification grid of mathematics 2061, the learning achievements of the students in mathematics are measured in four levels viz. knowledge, understanding, skill and problem solving. These are the four components which bring together the mathematical intuition and which further results to the mathematical discovery. If we segregate these to the extent of individual scope, naturally the knowledge and understanding remain a bit closer to a single domain and similarly skill has a distinct type of connection with problem solving than the others. In other words knowledge is the key to understanding whereas skill is the basis for problem solving. Thus, in this study it was expected that by studying the nature of two components (knowledge and skill), all the other will be represented to some extent. For getting the teachers' opinion regarding the level of mathematical knowledge and skill of the students, the researcher developed a questionnaire

asking the teachers to mention the units in the order from higher to lower. Since knowledge and skill are the two most dominant aspects of mathematical learning these are included in the questionnaire, though these are not the only aspects. The responses of the teachers so collected are tabulated below.

Table - 12

Number of Respondent Teachers on the units in which the mathematical knowledge and skill seemed poor

| Unit \ Order | I | II | III | IV | V |
|--------------|----|----|-----|----|----|
| Set | 1 | 1 | 3 | 4 | 6 |
| Arithmetic | 4 | 6 | 3 | 1 | 1 |
| Algebra | 2 | 3 | 3 | 4 | 3 |
| Geometry | 5 | 3 | 3 | 3 | 1 |
| Statistics | 3 | 2 | 3 | 3 | 4 |
| Total | 15 | 15 | 15 | 15 | 15 |

As per the teachers' responses it was found that a maximum of 5 teachers mentioned Geometry at number one and claimed that the mathematical knowledge and skill in Geometry is the poorest one. Three teachers each kept the unit at second, third and fourth order and a single teacher kept it at fifth. This again proves the fact. Similarly, a maximum of 6 teachers kept Arithmetic at second order, four kept it at first and three kept it at third order. This again shows that the two aspects of mathematical learning in Arithmetic are very poor according to the teachers' responses. Set is the unit mentioned at number five position by 6 teachers and at number four by four teachers. Just one teacher each mentioned Set at first and second order. This clearly shows that the two are comparatively stronger in Set than all other units. To talk about statistics, the number of teachers is distributed in the different orders almost evenly. But three teachers keeping it at third and four keeping at fifth show that the weight towards the side of stronger mathematical

knowledge and skill. Finally, the situation in Algebra was found almost similar to that in the statistics. In a nutshell, mathematical knowledge and skill in the three units Set, Algebra and Statistics cover a greater range than those in the units Arithmetic and Geometry.

4.2.7 Responses related to the units which are responsible to the failure of students in mathematics

This is the core questionnaire related to the responses of the teachers and even the strong and worthwhile direction for the present study. This is the foundation for the total study regarding the perspectives of the teachers on the different units taught in class eight. Thus the responses to this questionnaire are expected to be the conclusive and idea generating one for the entire study.

The respondent teachers were asked to mention the units in the order from higher to lower role in causing the failure of the students in the district level examination of class eight. Among 15 teachers five kept Arithmetic at first position and five kept it in second position, four positioned it at third and one at fourth whereas none of the teachers kept it at the fifth order. This shows that Arithmetic is the most responsible unit for the failure of the students in the district level examination of class VIII. The condition is almost similar in Geometry but not immediately same. A total of five teachers mentioned Geometry at the topmost order, four kept it at number two, three kept it in number three, two in number four and only one teacher kept it at number five. With this it can be concluded that the role of Geometry in failing the students in the district level examination comes at the second position i.e. Geometry is the second responsible unit for failure of the students.

Table - 13

**Respondent Teachers on the Units Causing Failure of Students in
Mathematics of District Level Examination of Class VIII**

| Unit \ Order | I | II | III | IV | V |
|--------------|----|----|-----|----|----|
| Set | 1 | 1 | 1 | 5 | 7 |
| Arithmetic | 5 | 5 | 4 | 1 | 0 |
| Algebra | 2 | 3 | 4 | 3 | 3 |
| Geometry | 5 | 4 | 3 | 2 | 1 |
| Statistics | 2 | 2 | 3 | 4 | 4 |
| Total | 15 | 15 | 15 | 15 | 15 |

According to the teachers' responses, the students' performance in Algebra seemed to be moderate. Among 15 teachers 2, 3, 4, 3 and 3 teachers kept Algebra at first, second, third, fourth and fifth order respectively. The two units Set and Statistics seemed to contribute the students securing the good scores as per the teachers' responses. If we look at the teachers' responses to the unit responsible for failure of students, one teacher each kept Set at first, second and third order whereas five kept it at number four and seven kept it at number five. And similar is the case in Statistics; two teachers each kept it in first and second position, three kept at third position and four teachers each kept it at fourth and fifth order. Thus the role of statistics for failing the students in mathematics is not as higher as that in Arithmetic and Geometry.

CHAPTER - V

SUMMARY, FINDING, CONCLUSION AND RECOMMENDATIONS

In this fifth and the final chapter of the present research it is tried to clarify in a nutshell, how this entire work was prosecuted, what the verdicts of the study are, what are the facts that the study could be able to foreground and how the study can be endorsed for the further studies. After expediting analysis and interpretation of the collected data, an attempt has been made to summarize and enlist the findings, conclusions and some recommendations for the further study. This chapter is further divided into subtopics.

5.1 Summary of the Study

The sole purpose of this study was to identify the units in the class 8 mathematics contents which have the significant role in making the students fail in the district level mathematics examination of class VIII. The existing mathematics curriculum of class 8 comprises of five different units as per the structure provided in the specification grid, though the units like Algebra, Arithmetic and Geometry cover a wider range than the units like Set and Statistics. There can be various factors responsible for the students to fail the mathematics in different examinations. One of the various reasons for failing the students in mathematics may be the inclusion of some unsuitable contents in the curriculum. The unit wise difficulty standard, performance level of the students and achievement indices are not yet covered by any study of the similar type. Thus it was necessary to identify such units from which large number of examinees could not solve the questions. With this intention the study was modelled to carry out.

This study was intended to find whether all the units prescribed for class eight were equally affecting the students' performance in the so called mini SLC examination. If not which are those causing higher failure rate? This was the main research question. The researcher included the students of five

different schools of Kaski district and fifteen mathematics teachers, who involved in examining the answer sheets of district level examination of the year 2064, in the sample population. The five sample schools were selected by the judgement sampling method and sixteen students from each sample school are chosen by using the stratified sampling method.

Prior to the data collection, the researcher consulted the school administration and requested to administer the pre district level examination in those schools. An achievement test was conducted in those schools. The test paper was prepared by the researcher based on the most recent specification grid provided for the district level examination. This test was standardized by a pilot test conducted in a school of Kaski district. Apart from this, the researcher also developed a questionnaire for to get the views of the teachers regarding the difficulty of the individual units and the performance of the average students. The questionnaire consisted of seven different questions each asking to mention the units in hierarchical order.

For the study of distribution of students over the different units, the students were classified into three groups as per the scores obtained in the achievement test. Those scoring less than 30% were kept in Warning group, students scoring in the range 30% to 60% were in Proficient group and those scoring more than 60% were in Advanced group. The scores of the students in each group were statistically analyzed by using a non-parametric test (Chi-square test) at 0.01 level of significance. Similarly, the data related to the teachers' views were tabulated and analyzed just by the observation of the numerical differences.

5.2 Findings of the study

After the analysis and interpretation of the collected data some important results and conclusions were drawn. The major findings of the present study are enlisted below:

- a) The number of warning students in each unit is not proportionally distributed over these units. Thus the failure rate in different units is not proportional.
- b) The number of proficient students in each unit is not proportionally distributed over all the units.
- c) The number of advanced students in different units is not proportionally distributed over the units.
- d) Students' performance in the units like Arithmetic and Geometry are comparatively poorer than the other units.
- e) Algebra is firmly contributing to show up little better result for the average students.
- f) Students are doing comparatively better in Set and Statistics than the other units.
- g) Arithmetic and Geometry are the two units causing higher failure rate in mathematics in the district level examination of class VIII.
- h) The achievement of students in the units like Set, Statistics and Algebra is better than achievement in overall mathematics.

5.3 Conclusion of the study

The different units, prescribed in class eight mathematics curriculums, are not all equally contributing for the achievement of the students and are not even equally responsible for the failure of the students. Thus from the perspective of the students it can be concluded that the curriculum comprised of some difficult units by which the students' mathematical learning and performance is hindered and badly affected.

5.4 Recommendations

From the findings of the present research the following immediate recommendations are suggested in order to minimize the failure rate in mathematics of district level examination of class VIII.

- ❖ As this study was limited to a few students from a few schools of a small geographical setting, there may be some logical shortcomings in the generalization of the research result. Thus it is strongly recommended to carry similar study by covering a large geographical frame with big sample size, most possibly in national level
- ❖ Since Arithmetic and Geometry affect widely in mathematical achievement of the students, it is necessary to investigate the factors which are responsible for the lower performance level in these units by the average students.
- ❖ In course of studying the similar researches, it was noted that the credits for data analysis, number and operations , statistical work and algebra is comparatively higher in grade eight mathematics than for other units in the various curriculum models of USA and in other countries. But the case is just opposite in our context. As the students are performing comparatively better in algebra and statistics than the other units it is necessary to investigate and overview the scope of the units prescribed in the curriculum.

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Appendix - 1

Lower Secondary Level Final Examination - Specification Grid 2061

Mathematics

Class - 8

| Area | S.N. | Level of Objective | Knowledge | | Understanding | | Skill | | Problem Solving | | Total No. of Questions | Total Marks | Time Allocation (Minutes) |
|------------|----------------------|---|------------------------|-------|---------------|-------|---------------|-------|-----------------|-------|------------------------|-------------|---------------------------|
| | | Type of Questions | Objective / Very Short | | Short | | Short / Long | | Long | | | | |
| | | Topics | No. of Quest. | Marks | No. of Quest. | Marks | No. of Quest. | Marks | No. of Quest. | Marks | | | |
| Set | 1 | Set | 2 | 2 | 1 | 2 | 1 | 2 | 1 | 4 | 5 | 10 | 18 |
| Arithmetic | 2 | Whole Number | | | 1 | 2 | 1 | 2 | 1 | 4 | 3 | 8 | 14.4 |
| | 3 | Integers (Square & Cubes) | | | | | | | | | | | |
| | 4 | Rationalization | | | | | | | | | | | |
| | 5 | Rational and Irrational Numbers | | | | | | | | | | | |
| | 6 | Ratio and Proportion | 1 | 1 | 1 | 2 | | | 1 | 4 | 3 | 7 | 12.6 |
| | 7 | Unitary Method | | | | | | | | | | | |
| | 8 | Percentage | | | | | | | | | | | |
| | 9 | Profit and Loss | 1 | 1 | | | | | 1 | 4 | 2 | 5 | 9 |
| 10 | Simple Interest | | | | | | | | | | | | |
| Statistics | 11 | Measure of Central Tendency | | | 1 | 2 | | | 1 | 4 | 2 | 6 | 10.8 |
| | 12 | Graph | | | | | 1 | 4 | | | 1 | 4 | 7.2 |
| Algebra | 13 | Algebraic Expression (Multiplication & Division) | 1 | 1 | 1 | 2 | 2 | 4 | 3 | 12 | 7 | 19 | 34.2 |
| | 14 | Indices | | | | | | | | | | | |
| | 15 | Factorization | | | | | | | | | | | |
| | 16 | H.C.F & L.C.M. | | | | | | | | | | | |
| | 17 | Rational Expression | 1 | 1 | 1 | 2 | 2 | 4 | 1 | 4 | 5 | 11 | 19.8 |
| | 18 | Linear Equation and Quadratic Equation | | | | | | | | | | | |
| 19 | Co-ordinate Geometry | | | | | | | | | | | | |
| Geometry | 20 | Angles and Parallel Lines | 1 | 1 | | | 1 | 2 | | | 2 | 3 | 5.4 |
| | 21 | Triangles & Polygons | | | 1 | 2 | 1 | 2 | | | 2 | 4 | 7.2 |
| | 22 | Construction | | | | | 1 | 4 | | | 1 | 4 | 7.2 |
| | 23 | Congruency and Similarity | | | | | 2 | 4 | | | 2 | 4 | 7.2 |
| | 24 | Verification | | | | | 1 | 4 | | | 1 | 4 | 7.2 |
| | 25 | Measurement (Mensuration, Perimeter, Area & Volume) | | | 1 | 2 | | | 1 | 4 | 2 | 6 | 10.8 |
| | 26 | Transformation | | | | | 1 | 4 | | | 1 | 4 | 7.2 |
| | 27 | Bearing and Scale Drawing | 1 | 1 | | | | | | | 1 | 1 | 1.8 |
| Total | | | 8 | 8 | 8 | 16 | 14 | 36 | 10 | 40 | 40 | 100 | 180 |

Appendix – 2

Achievement Test Paper for Pilot Test

अनिवार्य गणित

(Compulsory Mathematics)

कक्षा (Class) : 8

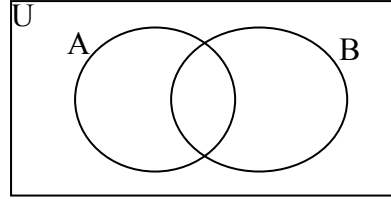
पूर्णाङ्क (Full Marks): 100

समय (Time): 3 hrs.

उत्तीर्णाङ्क (Pass Marks): 32

समूह क (Group A) $8 \times 1 = 8$

१. क) सँगैको भेन चित्र हेरेर समूह 'A' र समूह 'B' को सम्बन्ध लेख्नुहोस् । (From the Venn diagram given below, write the relation of set A and B.)



- ख) यदि समूह $X = \{a, b, c, d\}$ भए यसको कुनै एउटा उपसमूह लेख्नुहोस् । (If set $X = \{a, b, c, d\}$, write a subset of X.)
२. क) 12 कि.ग्रा. र 18 कि.ग्रा. को अनुपात लेख्नुहोस् । (Write the ratio of 12 kg to 18 kg.)
- ख) साँवा (P), समय (T) र साधारण ब्याज (I) भए ब्याजदर (R) निकाल्ने सूत्र लेख्नुहोस् । (If principal is P, time is T, simple interest is I, write the formula to find the rate of interest R)

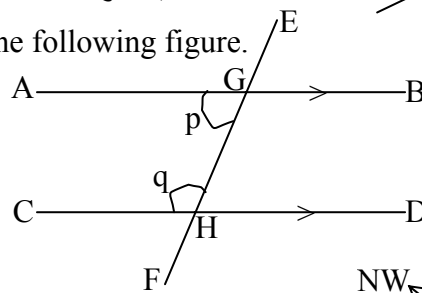
३. क) $(a-b)^3$ र $(a-b)^4$ को म.स. कति हुन्छ ? Find the HCF of $(a-b)^3$ and $(a-b)^4$.

ख) दिइएको रेखाखण्ड NM मा बिन्दु M को Y खण्ड पत्ता लगाउनुहोस् ।

Find the Y-intercept of the straight line NM from the figure alongside.

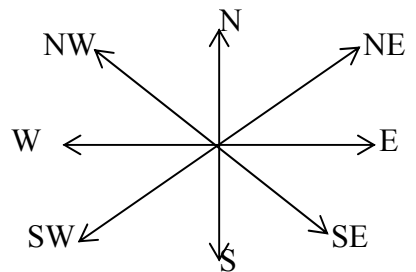
४. क) दिइएको चित्रमा p र q को योगफल निकाल्नुहोस् ।

Find the sum of p and q from the following figure.



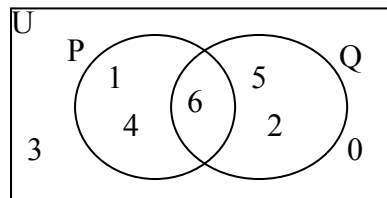
ख) कम्पासले देखाएको North West (NW) दिशा

स्थितीलाई कोणमा लेख्नुहोस् । (Find the bearing angle of North West (NW) from the figure given alongside.)



समूह ख (Group B) $18 \times 2 = 36$

५. क) दिइएको भेन चित्रबाट $P \cup S$ र $P \cap Q$ का मान पत्ता लगाउनुहोस् । (From the given Venn diagram find $P \cup S$ and $P \cap Q$.)



ख) यदि $X = \{a, e, i, o, u\}$ र $Y = \{a, b, c, d, e\}$ भए $X - Y$ लाई भेन चित्रमा देखाउनुहोस् । (If $X = \{a, e, i, o, u\}$ and $Y = \{a, b, c, d, e\}$, interpret $X - Y$ in a Venn diagram.)

६. क) सरल गर्नुहोस् (Simplify): $12\sqrt{3} + 3\sqrt{12}$

ख) 0.05471 लाई 3 सार्थ अङ्कसम्म शून्यान्त गर्नुहोस् । (Round off 0.05471 to 3 significant digits.)

ग) 40 कि.ग्रा. चामलको रु 800 पर्छ भने 1 कि.ग्रा. चामलको मोल पत्ता लगाउनुहोस् । (If the cost of 40 kg of rice is RS 800, find the cost of a kg of rice.)

७. क) तल दिइएको आकडाको मध्यक पत्ता लगाउनुहोस् । Find the mean from the following data.
6, 5, 25, 30, 18, 12

८. क) सरल गर्नुहोस् (Simplify): $\frac{a^3 + a^2}{a^2 + a}$

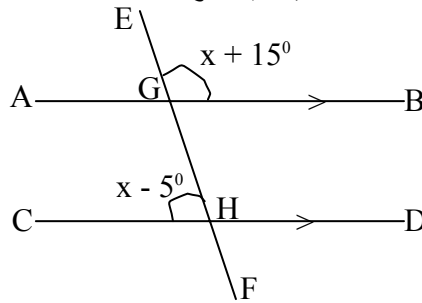
ख) मान निकाल्नुहोस् (Find the value of): $(9)^{0.5} \times (4)^{0.5}$

ग) खण्डिकरण गर्नुहोस् (Factorise): $35a^2 - ab - 6b^2$

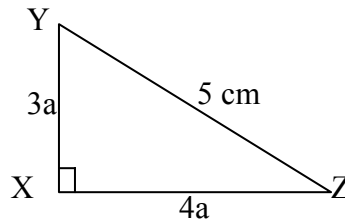
घ) रेखा चित्र $5x - 2y = 20$ को ऋकाव निकाल्नुहोस् । (Find the slope of the line $5x - 2y = 20$.)

ङ) संख्या रेखामा देखाउनुहोस् । (Express the given inequality in number line.) $3x < 4x + 2$

९. क) दिइएको चित्रबाट x को मान पत्ता लगाउनुहोस् । (Find the value of x from the following figure.)

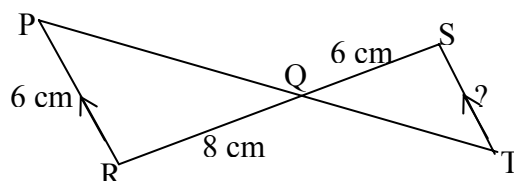


ख) दायाँको चित्रमा XY र XZ भुजाको नाप पत्ता लगाउनुहोस् । (Find the length of sides XY and XZ from the following figure.)

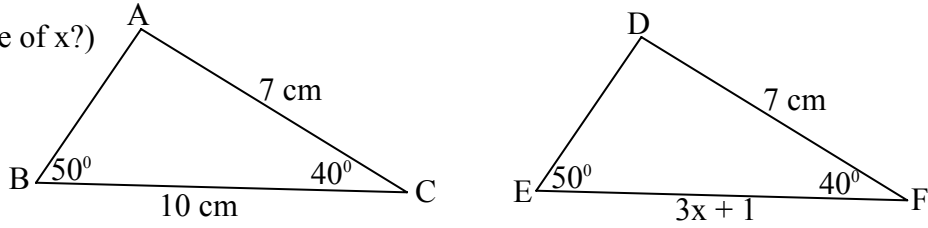


ग) नियमित षट्भुजको बाहिरी कोण पत्ता लगाउनुहोस् । (Find the exterior angle of the regular hexagon.)

घ) यदि ΔPQR र ΔTQS समरूप भए ST को नाप पत्ता लगाउनुहोस् । (If ΔPQR and ΔTQS are similar, find the length of ST .)



ड) $\triangle ABC$ र $\triangle DEF$ कुन अर्थ अनुसार अनुरूप हुन्छन् ? र x को मान पत्ता लगाउनुहोस् । (By which axiom the following triangles $\triangle ABC$ and $\triangle DEF$ are congruent and what is the value of x ?)



च) एउटा वृत्तको अर्धव्यास 21 से.मि. भए त्यसको आधा परिधी कति हुन्छ ? (What is the semi perimeter of the circle with radius 21 cm?)

समूह ग (Group C) 14×4 = 56

१०. यदि $U = \{1,2,3,4,5,6,7,8,9,10\}$, $A = \{1,3,5,7,9\}$, $B = \{2,3,5,7\}$ र $C = \{5,6,7,8,9\}$ भए (If $U = \{1,2,3,4,5,6,7,8,9,10\}$, $A = \{1,3,5,7,9\}$, $B = \{2,3,5,7\}$ and $C = \{5,6,7,8,9\}$, find)

क) $A \cap B \cap C$ पत्ता लगाई भेन चित्रबाट देखाउनुहोस् । (Find $A \cap B \cap C$ and illustrate it in Venn diagram)

ख) $(A \cup B) \cap C$ पत्ता लगाउनुहोस् । (Find $(A \cup B) \cap C$)

११. सरल गर्नुहोस् । (Simplify) : $10001111_2 + 11110_2 - 110111_2$.

१२. एउटा गाउँको वार्षिक जनसंख्या वृद्धिदर 5% छ । यदि अघिल्ला वर्षको जनसंख्या 15000 थियो भने आगामी वर्षको जनसंख्या कति पुग्छ होला ? (The population of a village increases every year by 5%. If the population of the village was 15000 last year, what will be that in the next year?)

१३. एकजना व्यापारीले 4 वटा सुन्तला रु 2 का दरले किनेर 5 वटा सुन्तलाको रु. 3 का दरले बेचेछ भने सो व्यापारमा उसको नाफा प्रतिशत कति हुन्छ? निकाल्नुहोस् । (A shopkeeper bought oranges at the rate of 4 per Rs 2 and sold at the rate of 5 per Rs 3. Find his profit in percentage.)

१४. दिइएको तालिकाबाट मध्यक पत्ता लगाउनुहोस् । (Find the mean from the data given below.)

| | | | | | |
|-------------------------------------|-------|-------|-------|-------|-------|
| प्राप्ताङ्क (Marks) | 10-20 | 20-30 | 30-40 | 40-50 | 50-60 |
| विद्यार्थी संख्या (No. of Students) | 4 | 6 | 8 | 5 | 2 |

१५. तल दिइएको तालिकाको आँकडालाई वृत्त चित्रमा प्रस्तुत गर्नुहोस् । (Illustrate the following information in a pie chart.)

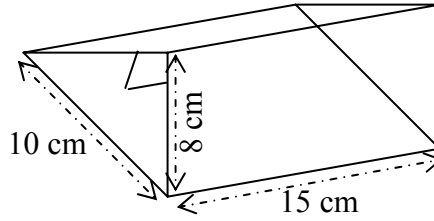
| | | | | | |
|-----------------------|--------------------|-------------|-------------|--------------------|----------------------|
| शीर्षक (Headings) | स्वास्थ्य (Health) | खाना (Food) | भाडा (Rent) | शिक्षा (Education) | अन्य (Miscellaneous) |
| खर्चहरू (Expenditure) | Rs 10000 | Rs 8000 | Rs 5000 | Rs 4000 | Rs 6000 |

१६. सरल गर्नुहोस् । (Simplify) : $\left(\frac{p^a}{p^b}\right)^{a+b} \times \left(\frac{p^b}{p^c}\right)^{b+c} \times \left(\frac{p^c}{p^a}\right)^{c+a}$

१७. म.स. र ल.स. निकाल्नुहोस् । (Find the LCM and HCF of) : $x^3 - 8$ and $x^2 - 5x + 6$.

१८. सरल गर्नुहोस् । (Simplify) : $\frac{1}{1+2a} + \frac{1}{1-2a} - \frac{4}{1-4a^2}$

१९. एकजना मानिस रु. १५ पर्ने एउटा कापी र रु. ४ पर्ने केही कलम किन्न चाहन्छ। यदि आफूसँग रु. १०० मात्र छ भने उसले बढीमा कति वटा कलम किन्न सकिएला? (A man wants to buy a copy costing Rs 15 and some pens costing Rs 4 each. If he has Rs 100, what maximum number of pens can he buy?)
२०. निम्न लिखित आँकडा अनुसार समानान्तर चतुर्भुज PQRS रचना गर्नुहोस्। (Construct a parallelogram PQRS with the given information) : $PQ = 5.5$ cm, $PR = 6.4$ cm and $\angle QPR = 60^\circ$.
२१. समद्विबाहु त्रिभुजका आधारका कोणहरु बराबर हुन्छन् भनी प्रयोगात्मक परीक्षणद्वारा साबित गर्नुहोस्। (Verify experimentally that the base angles of an isosceles triangle are equal.)
२२. दिइएको त्रिभुजाकार प्रिज्म आयतन निकाल्नुहोस्। (Find the volume of the following triangular prism.)



२३. शीर्षबिन्दु $A(2, 0)$, $B(6, 0)$, $C(6, 3)$ र $D(2, 3)$ भएको आयत ABCD लेखा चित्रमा खिच्नुहोस्। प्रत्येक बिन्दुलाई उद्गम बिन्दुकने वरिपरि $+90^\circ$ मा परिक्रमा गराउँदा बन्ने प्रतिबिम्बित बिन्दुहरु क्रमशः A' , B' , C' र D' पत्ता लगाइ सोही लेखा चित्रमा $A'B'C'D'$ देखाउनुहोस्। (Draw a rectangle $A(2, 0)$, $B(6, 0)$, $C(6, 3)$ and $D(2, 3)$ on a graph paper. Rotate the rectangle about the origin through $+90^\circ$ to find the images A' , B' , C' and D' . Also, show the rectangle $A'B'C'D'$ on the same graph.)

समाप्त

Appendix - 3
Item Analysis Table

| Student Item | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R | S | T | U | CR | P-Value | D-Value | Remarks | |
|-----------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|----|---------|---------|----------|----------|
| 1 | a | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 8 | 42% | 0.50 | Accepted | |
| | b | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 13 | 67% | 0.67 | Accepted |
| 2 | a | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 13 | 58% | 0.50 | Accepted |
| | b | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 11 | 50% | 0.67 | Accepted |
| 3 | a | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 12 | 67% | 0.33 | Accepted |
| | b | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 11 | 58% | 0.83 | Accepted |
| 4 | a | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 10 | 50% | 0.67 | Accepted |
| | b | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 10 | 50% | 0.67 | Accepted |
| 5 | a | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 11 | 58% | 0.83 | Accepted |
| | | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 11 | 50% | 1.00 | |
| | b | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 9 | 50% | 0.67 | Accepted |
| | | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 10 | 58% | 0.83 | |
| 6 | a | 1 | 1 | 0 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 12 | 58% | 0.50 | Modified |
| | | 0 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 10 | 42% | 0.17 | |
| | b | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 13 | 75% | 0.50 | Accepted |
| | | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 11 | 50% | 0.67 | |
| | c | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 42% | 0.83 | Accepted |
| 1 | | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 11 | 42% | 0.50 | | |
| 7 | | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 12 | 67% | 0.33 | Accepted |
| | | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 10 | 50% | 0.33 | |
| 8 | a | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 9 | 50% | 0.67 | Accepted |
| | | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9 | 42% | 0.83 | |
| | b | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 10 | 58% | 0.50 | Accepted |
| | | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 10 | 50% | 0.67 | |
| | c | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 11 | 58% | 0.83 | Accepted |
| | | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 9 | 50% | 0.67 | |
| | d | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 12 | 58% | 0.50 | Accepted |
| | | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 12 | 58% | 0.50 | |
| | e | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 17% | 0.33 | Rejected |
| | | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 25% | 0.50 | |
| | f | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 12 | 67% | 0.67 | Accepted |
| | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 11 | 58% | 0.83 | |

| Student Item | | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R | S | T | U | CR | P-Value | D-Value | Remarks | |
|--------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|----|-----|---------|----------|----------|----------|
| 9 | a | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 10 | 50% | 0.67 | Accepted | |
| | | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 13 | 67% | 0.67 | | |
| | b | 1 | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 11 | 50% | 0.33 | Accepted | |
| | | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 12 | 50% | 0.67 | | |
| | c | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 11 | 58% | 0.50 | Accepted | |
| | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 12 | 67% | 0.67 | | |
| | d | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 9 | 58% | 0.50 | Accepted |
| | | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 11 | 50% | 0.33 | | |
| | e | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 11 | 58% | 0.83 | Accepted | |
| | | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 7 | 42% | 0.50 | | |
| | f | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 9 | 42% | 0.50 | Accepted | |
| | | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 10 | 50% | 0.67 | | |
| 10 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 9 | 50% | 0.67 | Accepted | | |
| | 1 | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 11 | 42% | 0.50 | | | |
| | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 13 | 75% | 0.50 | | | |
| | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 11 | 42% | 0.17 | | | |
| 11 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 8 | 42% | 0.50 | Modified | | |
| | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 9 | 42% | 0.83 | | | |
| | 1 | 1 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 9 | 42% | 0.50 | | | |
| | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 5 | 33% | 0.33 | | | |
| 12 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 10 | 50% | 0.67 | Modified | | |
| | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 8 | 25% | 0.50 | | | |
| | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 13 | 58% | 0.83 | | | |
| | 1 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 9 | 42% | 0.50 | | | |
| 13 | 1 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 7 | 50% | 0.67 | Accepted | | |
| | 1 | 1 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 8 | 42% | 0.50 | | | |
| | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 8 | 42% | 0.50 | | | |
| | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 10 | 50% | 0.67 | | | |
| 14 | 1 | 1 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 10 | 50% | 0.33 | Accepted | | |
| | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 12 | 67% | 0.33 | | | |
| | 1 | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 10 | 50% | 0.33 | | | |
| | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 13 | 50% | 0.67 | | | |
| 15 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 6 | 25% | 0.17 | Rejected | | |
| | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 8 | 42% | 0.50 | | | |
| | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 17% | 0.33 | | | |
| | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 7 | 25% | 0.17 | | | |

| Student Item | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R | S | T | U | CR | P-Value | D-Value | Remarks |
|--------------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|---------|---------|----------|
| 16 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 12 | 67% | 0.67 | Accepted |
| | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 11 | 58% | 0.50 | |
| | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 9 | 42% | 0.50 | |
| | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 11 | 50% | 1.00 | |
| 17 | 1 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 10 | 58% | 0.17 | Accepted |
| | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 11 | 42% | 0.83 | |
| | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 10 | 42% | 0.17 | |
| | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 9 | 50% | 0.33 | |
| 18 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 12 | 50% | 0.67 | Accepted |
| | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 9 | 50% | 0.33 | |
| | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9 | 42% | 0.83 | |
| | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 11 | 42% | 0.50 | |
| 19 | 1 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 10 | 50% | 0.67 | Accepted |
| | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 8 | 50% | 1.00 | |
| | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 8 | 50% | 0.67 | |
| | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 12 | 50% | 0.33 | |
| 20 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 12 | 42% | 0.83 | Accepted |
| | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 9 | 42% | 0.50 | |
| | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 8 | 42% | 0.50 | |
| | 0 | 1 | 1 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 8 | 50% | 0.33 | |
| 21 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 12 | 50% | 0.67 | Accepted |
| | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 9 | 58% | 0.83 | |
| | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 11 | 58% | 0.50 | |
| | 0 | 1 | 1 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 6 | 42% | 0.50 | |
| 22 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 1 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 11 | 50% | 0.67 | Modified |
| | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 7 | 42% | 0.50 | |
| | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 9 | 33% | 0.33 | |
| | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 25% | 0.50 | |
| 23 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 7 | 33% | 0.33 | Modified |
| | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 8 | 50% | 0.33 | |
| | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 25% | 0.50 | |
| | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 7 | 33% | 0.33 | |
| Total | 91 | 85 | 78 | 77 | 65 | 60 | 58 | 56 | 49 | 46 | 44 | 38 | 35 | 35 | 32 | 27 | 27 | 23 | 18 | 15 | 14 | | | | |

P-Value = Difficulty Level
D-Value = Discrimination Index
CR = Correct Response

Appendix – 4

Achievement Test Paper for Final Test

अनिवार्य गणित

(Compulsory Mathematics)

कक्षा (Class) :8

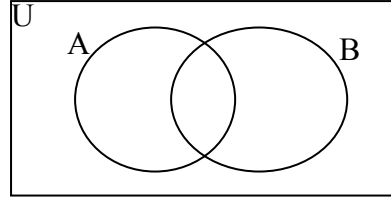
पूर्णाङ्क (Full Marks): 100

समय (Time): 3 hrs.

उत्तीणाङ्क (Pass Marks): 32

समूह क (Group A) $8 \times 1 = 8$

१. क) सँगैको भेन चित्र हेरेर समूह 'A' र समूह 'B' को सम्बन्ध लेख्नुहोस् । (From the Venn diagram given below, write the relation of set A and B.)



- ख) यदि समूह $X = \{a, b, c, d\}$ भए यसको कुनै एउटा उपसमूह लेख्नुहोस् । (If set $X = \{a, b, c, d\}$, write a subset of X.)
२. क) 12 कि.ग्रा. र 18 कि.ग्रा. को अनुपात लेख्नुहोस् । (Write the ratio of 12 kg to 18 kg.)
- ख) साँवा (P), समय (T) र साधारण ब्याज (I) भए ब्याजदर (R) निकाल्ने सूत्र लेख्नुहोस् । (If principal is P, time is T, simple interest is I, write the formula to find the rate of interest R)

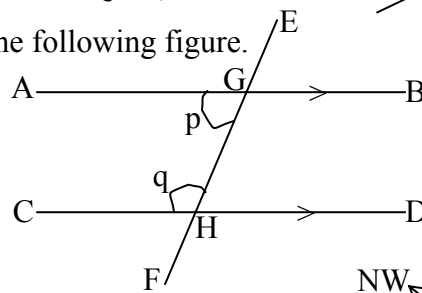
३. क) $(a-b)^3$ र $(a-b)^4$ को म.स. कति हुन्छ ? Find the HCF of $(a-b)^3$ and $(a-b)^4$.

ख) दिइएको रेखाखण्ड NM मा बिन्दु M को Y खण्ड पत्ता लगाउनुहोस् ।

Find the Y-intercept of the straight line NM from the figure alongside.

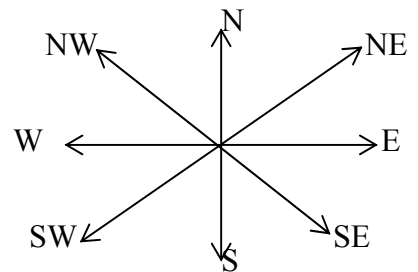
४. क) दिइएको चित्रमा p र q को योगफल निकाल्नुहोस् ।

Find the sum of p and q from the following figure.



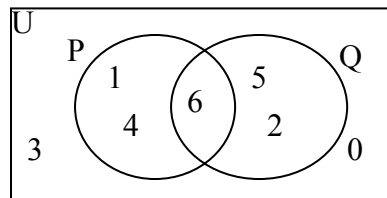
ख) कम्पासले देखाएको North West (NW) दिशा

स्थितीलाई कोणमा लेख्नुहोस् । (Find the bearing angle of North West (NW) from the figure given alongside.)



समूह ख (Group B) $18 \times 2 = 36$

५. क) दिइएको भेन चित्रबाट $P \cup S$ र $P \cap Q$ का मान पत्ता लगाउनुहोस् । (From the given Venn diagram find $P \cup S$ and $P \cap Q$.)



ख) यदि $X = \{a, e, i, o, u\}$ र $Y = \{a, b, c, d, e\}$ भए $X - Y$ लाई भेन चित्रमा देखाउनुहोस् । (If $X = \{a, e, i, o, u\}$ and $Y = \{a, b, c, d, e\}$, interpret $X - Y$ in a Venn diagram.)

६. क) सरल गर्नुहोस् (Simplify): $2\sqrt{2} - \sqrt{8}$

ख) 0.05471 लाई 3 सार्थ अङ्कसम्म शून्यान्त गर्नुहोस् । (Round off 0.05471 to 3 significant digits.)

ग) 40 कि.ग्रा. चामलको रु 800 पर्छ भने 1 कि.ग्रा. चामलको मोल पत्ता लगाउनुहोस् । (If the cost of 40 kg of rice is RS 800, find the cost of a kg of rice.)

७. क) तल दिइएको आकडाको मध्यक पत्ता लगाउनुहोस् । Find the mean from the following data.
6, 5, 25, 30, 18, 12

८. क) सरल गर्नुहोस् (Simplify): $\frac{a^3 + a^2}{a^2 + a}$

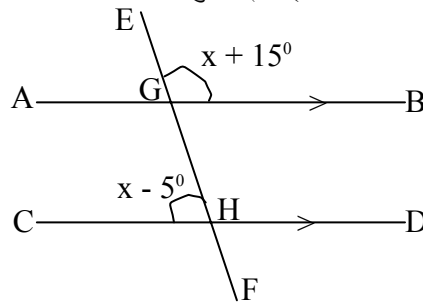
ख) मान निकाल्नुहोस् (Find the value of): $(9)^{0.5} \times (4)^{0.5}$

ग) खण्डिकरण गर्नुहोस् (Factorize): $35a^2 - ab - 6b^2$

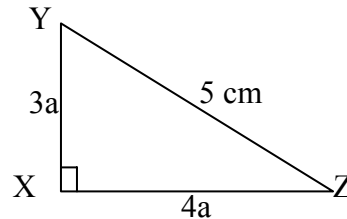
घ) रेखा चित्र $5x - 2y = 20$ को ऋकाव निकाल्नुहोस् । (Find the slope of the line $5x - 2y = 20$.)

ङ) यदि x एउटा 10 भन्दा सानो प्राकृतिक संख्या भए x का सम्भावित मानहरु पत्ता लगाउनुहोस् । (If x is a natural number less than 10, find the possible values of x): $3x < 4x - 6$

९. क) दिइएको चित्रबाट x को मान पत्ता लगाउनुहोस् । (Find the value of x from the following figure.)

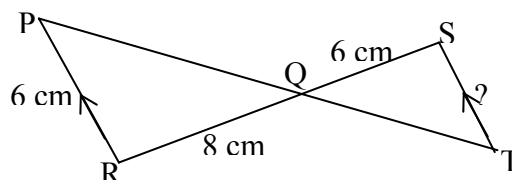


ख) दायाँको चित्रमा XY र XZ भुजाको नाप पत्ता लगाउनुहोस् । (Find the length of sides XY and XZ from the following figure.)

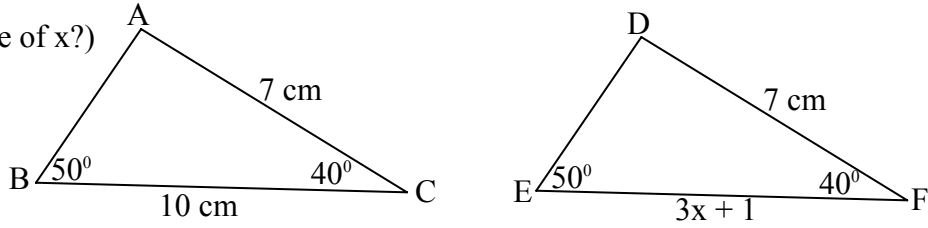


ग) नियमित षट्भुजको बाहिरी कोण पत्ता लगाउनुहोस् । (Find the exterior angle of the regular hexagon.)

घ) यदि ΔPQR र ΔTQS समरूप भए ST को नाप पत्ता लगाउनुहोस् । (If ΔPQR and ΔTQS are similar, find the length of ST.)



ड) $\triangle ABC$ र $\triangle DEF$ कुन अर्थ अनुसार अनुरूप हुन्छन् ? र x को मान पत्ता लगाउनुहोस् । (By which axiom the following triangles $\triangle ABC$ and $\triangle DEF$ are congruent and what is the value of x ?)



च) एउटा वृत्तको अर्धव्यास 21 से.मि. भए त्यसको आधा परिधी कति हुन्छ ? (What is the semi perimeter of the circle with radius 21 cm?)

समूह ग (Group C) 14×4 = 56

१०. यदि $U = \{1,2,3,4,5,6,7,8,9,10\}$, $A = \{1,3,5,7,9\}$, $B = \{2,3,5,7\}$ र $C = \{5,6,7,8,9\}$ भए (If $U = \{1,2,3,4,5,6,7,8,9,10\}$, $A = \{1,3,5,7,9\}$, $B = \{2,3,5,7\}$ and $C = \{5,6,7,8,9\}$, find)

क) $A \cap B \cap C$ पत्ता लगाई भेन चित्रबाट देखाउनुहोस् । (Find $A \cap B \cap C$ and illustrate it in Venn diagram)

ख) $(A \cup B) \cap C$ पत्ता लगाउनुहोस् । (Find $(A \cup B) \cap C$)

११. सरल गर्नुहोस् । (Simplify) : $11111_2 + 1100_2 - 11001_2$.

१२. एउटा कामदारको वार्षिक आमदानी रु 60000 छ । यदि उसको मासिक खर्च रु 3500 भए उसले वार्षिक कति प्रतिशत बचत गर्छ ? (The annual income of a worker is Rs60000. If his monthly expenditure is Rs 3500, what is his annual savings in percentage?)

१३. एकजना व्यापारीले एउटा घडी रु 600 मा किनेर 10% नाफामा बेचेछ । उक्त घडीको विक्रय मूल्य पत्ता लगाउनुहोस् । (A shopkeeper bought a watch for Rs 600 and sold at a profit of 10%. Find the selling price of the watch.)

१४. दिइएको तालिकाबाट मध्यक पत्ता लगाउनुहोस् । (Find the mean from the data given below.)

| | | | | | |
|-------------------------------------|-------|-------|-------|-------|-------|
| प्राप्ताङ्क (Marks) | 10-20 | 20-30 | 30-40 | 40-50 | 50-60 |
| विद्यार्थी संख्या (No. of Students) | 4 | 6 | 8 | 5 | 2 |

१५. तल दिइएको तालिकाको आँकडालाई वृत्त चित्रमा प्रस्तुत गर्नुहोस् । (Illustrate the following information in a pie chart.)

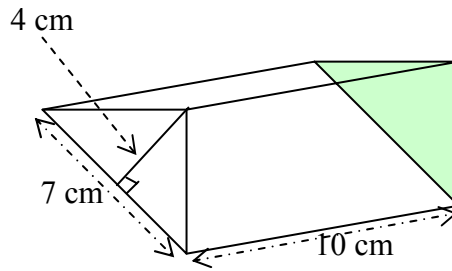
| | | | | | |
|-----------------------|--------------------|-------------|-------------|--------------------|----------------------|
| शीर्षक (Headings) | स्वास्थ्य (Health) | खाना (Food) | भाडा (Rent) | शिक्षा (Education) | अन्य (Miscellaneous) |
| खर्चहरू (Expenditure) | Rs 10000 | Rs 8000 | Rs 5000 | Rs 4000 | Rs 6000 |

१६. सरल गर्नुहोस् । (Simplify) : $\left(\frac{p^a}{p^b}\right)^{a+b} \times \left(\frac{p^b}{p^c}\right)^{b+c} \times \left(\frac{p^c}{p^a}\right)^{c+a}$

१७. म.स. र ल.स. निकाल्नुहोस् । (Find the LCM and HCF of) : $x^3 - 8$ and $x^2 - 5x + 6$.

१८. सरल गर्नुहोस् । (Simplify) : $\frac{1}{1+2a} + \frac{1}{1-2a} - \frac{4}{1-4a^2}$

१९. एकजना मानिस रु. १५ पर्ने एउटा कापी र रु. ४ पर्ने केही कलम किन्न चाहन्छ। यदि आफूसँग रु. १०० मात्र छ भने उसले बढीमा कति वटा कलम किन्न सकिएला? (A man wants to buy a copy costing Rs 15 and some pens costing Rs 4 each. If he has Rs 100, what maximum number of pens can he buy?)
२०. निम्न लिखित आँकडा अनुसार समानान्तर चतुर्भुज PQRS रचना गर्नुहोस्। (Construct a parallelogram PQRS with the given information) : $PQ = 5.5$ cm, $PR = 6.4$ cm and $\angle QPR = 60^\circ$.
२१. समद्विबाहु त्रिभुजका आधारका कोणहरू बराबर हुन्छन् भनी प्रयोगात्मक परीक्षणद्वारा साबित गर्नुहोस्। (Verify experimentally that the base angles of an isosceles triangle are equal.)
२२. दिइएको त्रिभुजाकार प्रिज्म आयतन निकाल्नुहोस्। (Find the volume of the following triangular prism.)



२३. शीर्षबिन्दु $A(2, 1)$, $B(6, 2)$, $C(6, 5)$ र $D(2, 4)$ भएको चतुर्भुज ABCD लेखा चित्रमा खिच्नुहोस्। प्रत्येक बिन्दुलाई X-अक्षमा परावर्तन गराउँदा बन्ने प्रतिबिम्बित बिन्दुहरू क्रमशः A' , B' , C' र D' पत्ता लगाइ सोही लेखा चित्रमा $A'B'C'D'$ देखाउनुहोस्। (Draw a quadrilateral ABCD with vertices $A(2, 1)$, $B(6, 2)$, $C(6, 5)$ and $D(2, 4)$ on a graph paper. Reflect the quadrilateral in the X-axis to find the images A' , B' , C' and D' . Also, show the quadrilateral $A'B'C'D'$ on the same graph.)

समाप्त

MAJOR FACTORS CAUSING HIGHER FAILURE RATE IN DISTRICT LEVEL EXAMINATION OF CLASS VIII

Questionnaire for collecting the view of teachers about the various weaknesses from the students in the examinations

आदरणीय शिक्षक मित्रहरु,

गणित शिक्षामा स्नातकोत्तर उपाधि हासिल गर्नका लागि विश्वविद्यालयद्वारा तय गरिएको पाठ्यक्रमको एउटा अंशका रूपमा मैले कक्षा-८ को जिल्ला स्तरीय परीक्षामा विद्यार्थीहरु फेल हुनुमा बढी भूमिका रहेका पाठ्यवस्तुहरुको अनुसन्धान – MAJOR UNITS CAUSING HIGHER FAILURE RATE IN DISTRICT LEVEL EXAMINATION OF CLASS VIII – नामक शोधपत्र तयार गर्न लागेको छु । यस कार्यको नमूना संकलन का लागि तयार गरिएको प्रश्नावली अध्ययन गरी अपेक्षित उत्तर प्रस्तुत गर्नुभई सहयोग गरिदिनु हुन हार्दिक अनुरोध गर्दछु । यस अध्ययनको वैधता र विश्वसनीयता तपाईंहरुको पक्षपात रहित प्रतिक्रियामा निर्भर गर्दछ । तपाईंहरुको प्रतिक्रियालाई यस अनुसन्धानका लागि मात्र प्रयोग गरिनेछ, र आवश्यकता अनुसार गोप्य राखिनेछ ।

तलका प्रश्नहरु राम्ररी अध्ययन गरी प्रत्येक प्रश्नले सोधेका एकाइहरु मध्ये प्राथमिकताका आधारमा क्रम मिलाएर लेख्नुहोस् ।

१. मध्यमस्तरका विद्यार्थीहरुले समाधान गर्न प्रयत्न नै नगरेका प्रश्नहरु कुन कुन एकाइसँग संबन्धित छन् ? (समूह, अंकगणित, विजगणित, ज्यामिति, तथ्याङ्कशास्त्र)

I) _____

II) _____

III) _____

IV) _____

V) _____

२. उत्तीर्णाङ्क भन्दा केही कम वा केही बढी अंक प्राप्त गर्ने विद्यार्थीहरुले समाधान गर्न प्रयात्न गरेर पनि सही समाधान निकाल्न नसकेका प्रश्नहरु कुन कुन एकाइसँग सम्बन्धित छन् ?

- D) _____
- II) _____
- III) _____
- IV) _____
- V) _____

३. शिक्षण शैलीको कारणबाट अधिकांश विद्यार्थीहरूले एकै प्रकारका कमजोरीहरू गर्छन् भने फरक किसिमका गल्तीहरू पाठ्यवस्तुको कठिनाईका कारण हुनसक्छन् । यस्ता फरक किसिमका गल्तीहरू देखिएका प्रश्नहरू कुन कुन एकाईसँग सम्बन्धित छन् क्रम मिलाएर लेख्नुहोस् ।

- D) _____
- II) _____
- III) _____
- IV) _____
- V) _____

४. ज्ञान र बोधसँग सम्बन्धित सरल प्रश्नहरू समाधान गर्न नसक्नु तर सोही एकाइबाट सोधिएका कठिन समस्याहरू समाधान हुनुले विश्वसनीयता कम गराउँछ । यस कारणले विद्यार्थीको सीकाइ उपलब्धीमा कम विश्वसनीयता देखिएका एकाइहरू क्रम मिलाएर लेख्नुहोस् ।

- D) _____
- II) _____
- III) _____
- IV) _____
- V) _____

५. विद्यार्थीहरूले समाधान गर्न नसकेका प्रश्नहरू पाठ्यक्रम तथा विषयवस्तुसँग असम्बन्धित पनि हुनसक्छन् वा विद्यार्थीको कमजोर सिकाइका कारणले यदि विद्यार्थीको कमजोर सिकाइ उपलब्धीका कारणले भए कुन कुन एकाइबाट छन् क्रममा राख्नुहोस् ।

- D) _____
- II) _____
- III) _____
- IV) _____
- V) _____

६. गणितीय सिकाइमा आवश्यक ज्ञान र बोधको कमीले नै गणितीय धारणको विकासमा असर पार्छ । आवश्यक ज्ञान तथा बोधको कमी देखिएका एकाइहरूलाई क्रम मिलाएर लेख्नुहोस् ।

- I) _____
- II) _____
- III) _____
- IV) _____
- V) _____

७. समग्रमा कक्षा-८ को जिल्ला स्तरीय परीक्षामा गणितमा विद्यार्थीहरू फेल हुनुमा बढी भूमिका रहेका एकाइहरूलाई प्राथमिकता क्रममा लेख्नुहोस् ।

- I) _____
- II) _____
- III) _____
- IV) _____
- V) _____

गणित शिक्षणका क्रममा आफूले संगालेका अनुभवका आधारमा अन्य कुनै सम्बन्धित धारणा भए उल्लेख गर्नुहोस् ।

मिति: _____

परिक्षकको नाम: _____ हस्ताक्षर: _____

विद्यालयको नाम तथा ठेगाना: _____

Appendix - 6

Unit Wise Scores of Students In Achievement Test

| Student Code | Sets | Arithmetic | Algebra | Geometry | Statistics | Total |
|--------------|---------|------------|---------|----------|------------|----------|
| | FM - 10 | FM - 20 | FM - 30 | FM - 30 | FM - 10 | FM - 100 |
| 1 | 4 | 4 | 12 | 9 | 4 | 33 |
| 2 | 3 | 1 | 9 | 2 | 2 | 17 |
| 3 | 4 | 5 | 9 | 5 | 2 | 25 |
| 4 | 10 | 18 | 29 | 25 | 10 | 92 |
| 5 | 5 | 10 | 21 | 13 | 8 | 57 |
| 6 | 8 | 5 | 16 | 6 | 10 | 45 |
| 7 | 2 | 4 | 9 | 4 | 2 | 21 |
| 8 | 5 | 1 | 13 | 3 | 0 | 22 |
| 9 | 7 | 10 | 22 | 8 | 5 | 52 |
| 10 | 10 | 15 | 19 | 18 | 10 | 72 |
| 11 | 4 | 2 | 15 | 10 | 1 | 32 |
| 12 | 1 | 1 | 8 | 7 | 4 | 21 |
| 13 | 9 | 17 | 15 | 12 | 8 | 61 |
| 14 | 4 | 3 | 12 | 6 | 2 | 27 |
| 15 | 4 | 5 | 3 | 4 | 2 | 18 |
| 16 | 8 | 14 | 18 | 9 | 8 | 57 |
| 17 | 7 | 4 | 16 | 12 | 8 | 47 |
| 18 | 2 | 6 | 10 | 4 | 1 | 23 |
| 19 | 10 | 20 | 25 | 25 | 10 | 90 |
| 20 | 6 | 1 | 9 | 8 | 5 | 29 |
| 21 | 4 | 4 | 9 | 5 | 1 | 23 |
| 22 | 7 | 17 | 15 | 13 | 8 | 60 |
| 23 | 2 | 5 | 11 | 5 | 2 | 25 |
| 24 | 5 | 3 | 7 | 8 | 2 | 25 |
| 25 | 3 | 10 | 12 | 8 | 7 | 40 |
| 26 | 7 | 4 | 8 | 5 | 6 | 30 |
| 27 | 1 | 4 | 15 | 10 | 2 | 32 |
| 28 | 6 | 11 | 16 | 16 | 8 | 57 |
| 29 | 9 | 16 | 28 | 27 | 8 | 88 |
| 30 | 6 | 13 | 27 | 10 | 5 | 61 |
| 31 | 4 | 2 | 4 | 6 | 2 | 18 |
| 32 | 5 | 4 | 16 | 9 | 6 | 40 |
| 33 | 3 | 7 | 6 | 7 | 2 | 25 |
| 34 | 8 | 12 | 16 | 11 | 6 | 53 |
| 35 | 6 | 5 | 12 | 7 | 2 | 32 |
| 36 | 5 | 11 | 15 | 10 | 5 | 46 |
| 37 | 5 | 4 | 12 | 8 | 4 | 33 |
| 38 | 8 | 3 | 14 | 6 | 5 | 36 |
| 39 | 5 | 7 | 12 | 13 | 3 | 40 |
| 40 | 9 | 17 | 23 | 17 | 8 | 74 |
| 41 | 10 | 8 | 16 | 8 | 6 | 48 |
| 42 | 4 | 1 | 7 | 7 | 1 | 20 |
| 43 | 6 | 15 | 25 | 20 | 4 | 70 |
| 44 | 8 | 14 | 17 | 16 | 8 | 63 |

| Student Code | Sets | Arithmetic | Algebra | Geometry | Statistics | Total |
|--------------|---------|------------|---------|----------|------------|----------|
| | FM - 10 | FM - 20 | FM - 30 | FM - 30 | FM - 10 | FM - 100 |
| 45 | 7 | 6 | 18 | 21 | 7 | 59 |
| 46 | 5 | 11 | 12 | 12 | 2 | 42 |
| 47 | 5 | 13 | 18 | 14 | 9 | 59 |
| 48 | 4 | 3 | 16 | 7 | 2 | 32 |
| 49 | 7 | 9 | 18 | 15 | 7 | 56 |
| 50 | 8 | 11 | 21 | 20 | 10 | 70 |
| 51 | 10 | 18 | 30 | 28 | 10 | 96 |
| 52 | 2 | 0 | 7 | 3 | 2 | 14 |
| 53 | 3 | 4 | 9 | 8 | 0 | 24 |
| 54 | 5 | 3 | 14 | 4 | 8 | 34 |
| 55 | 4 | 5 | 14 | 12 | 5 | 40 |
| 56 | 8 | 6 | 15 | 15 | 8 | 52 |
| 57 | 1 | 5 | 4 | 3 | 2 | 15 |
| 58 | 5 | 11 | 17 | 10 | 8 | 51 |
| 59 | 5 | 10 | 12 | 13 | 7 | 47 |
| 60 | 4 | 6 | 12 | 2 | 1 | 25 |
| 61 | 9 | 15 | 22 | 16 | 8 | 70 |
| 62 | 5 | 4 | 21 | 7 | 6 | 43 |
| 63 | 4 | 11 | 14 | 12 | 3 | 44 |
| 64 | 5 | 8 | 17 | 14 | 7 | 51 |
| 65 | 4 | 4 | 8 | 4 | 3 | 23 |
| 66 | 4 | 9 | 13 | 5 | 2 | 33 |
| 67 | 6 | 10 | 14 | 17 | 6 | 53 |
| 68 | 5 | 4 | 12 | 8 | 4 | 33 |
| 69 | 1 | 5 | 7 | 1 | 3 | 17 |
| 70 | 4 | 5 | 11 | 5 | 1 | 26 |
| 71 | 3 | 9 | 13 | 7 | 3 | 35 |
| 72 | 4 | 11 | 15 | 8 | 8 | 46 |
| 73 | 5 | 5 | 11 | 3 | 5 | 29 |
| 74 | 2 | 3 | 7 | 5 | 4 | 21 |
| 75 | 6 | 5 | 6 | 2 | 4 | 23 |
| 76 | 1 | 7 | 14 | 8 | 3 | 33 |
| 77 | 7 | 9 | 15 | 10 | 8 | 49 |
| 78 | 5 | 10 | 15 | 8 | 7 | 45 |
| 79 | 4 | 7 | 13 | 6 | 4 | 34 |
| 80 | 5 | 5 | 12 | 7 | 3 | 32 |

Appendix - 7

Teachers' Responses on the Questionnaire

| Teacher Question | T - 1 | T - 2 | T - 3 | T - 4 | T - 5 | T - 6 | T - 7 | T - 8 | T - 9 | T - 10 | T - 11 | T - 12 | T - 13 | T - 14 | T - 15 |
|---------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|--------|--------|--------|--------|--------|
| Q - 1 | Ari | Geo | Ari | Ari | Ari | Geo | Geo | Sta | Ari | Ari | Alg | Ari | Geo | Sta | Ari |
| | Geo | Sta | Alg | Geo | Sta | Set | Ari | Geo | Alg | Geo | Sta | Geo | Ari | Ari | Geo |
| | Set | Ari | Geo | Alg | Geo | Ari | Alg | Alg | Geo | Sta | Geo | Set | Alg | Alg | Set |
| | Sta | Alg | Set | Set | Set | Sta | Set | Ari | Sta | Set | Ari | Sta | Set | Geo | Sta |
| | Alg | Set | Sta | Sta | Alg | Alg | Sta | Set | Set | Alg | Set | Alg | Sta | Set | Alg |
| Q - 2 | Alg | Geo | Geo | Ari | Alg | Geo | Ari | Sta | Set | Geo | Alg | Sta | Ari | Geo | Alg |
| | Sta | Ari | Set | Alg | Ari | Alg | Geo | Ari | Alg | Ari | Ari | Set | Geo | Set | Geo |
| | Geo | Set | Ari | Geo | Set | Ari | Alg | Geo | Ari | Alg | Geo | Ari | Alg | Sta | Ari |
| | Set | Sta | Alg | Set | Geo | Sta | Sta | Set | Geo | Set | Sta | Geo | Sta | Alg | Set |
| | Ari | Alg | Sta | Sta | Sta | Set | Set | Alg | Sta | Sta | Set | Alg | Set | Ari | Sta |
| Q - 3 | Geo | Set | Ari | Alg | Geo | Alg | Ari | Geo | Geo | Alg | Sta | Ari | Geo | Sta | Geo |
| | Alg | Ari | Geo | Geo | Alg | Sta | Alg | Ari | Ari | Ari | Set | Geo | Alg | Alg | Ari |
| | Sta | Geo | Alg | Ari | Set | Geo | Geo | Sta | Set | Geo | Ari | Alg | Ari | Ari | Alg |
| | Ari | Sta | Set | Set | Sta | Ari | Set | Set | Sta | Set | Geo | Set | Sta | Geo | Set |
| | Set | Alg | Sta | Sta | Ari | Set | Sta | Alg | Alg | Sta | Alg | Sta | Set | Set | Sta |
| Q - 4 | Ari | Geo | Alg | Geo | Alg | Geo | Alg | Set | Sta | Set | Alg | Alg | Ari | Sta | Set |
| | Sta | Ari | Ari | Alg | Ari | Ari | Set | Geo | Set | Alg | Sta | Geo | Set | Alg | Sta |
| | Geo | Sta | Geo | Ari | Set | Set | Sta | Sta | Alg | Geo | Set | Ari | Sta | Ari | Geo |
| | Alg | Set | Set | Set | Geo | Sta | Ari | Alg | Geo | Sta | Ari | Set | Geo | Set | Alg |
| | Set | Alg | Sta | Sta | Sta | Alg | Geo | Ari | Ari | Ari | Geo | Sta | Alg | Geo | Ari |
| Q - 5 | Geo | Ari | Ari | Alg | Geo | Ari | Sta | Geo | Ari | Geo | Alg | Sta | Geo | Ari | Geo |
| | Alg | Alg | Geo | Sta | Alg | Alg | Geo | Ari | Alg | Ari | Ari | Geo | Set | Sta | Alg |
| | Ari | Sta | Alg | Set | Ari | Geo | Ari | Alg | Geo | Sta | Geo | Ari | Alg | Set | Set |
| | Set | Geo | Sta | Geo | Set | Set | Set | Sta | Set | Set | Sta | Alg | Sta | Alg | Ari |
| | Sta | Set | Set | Ari | Sta | Sta | Alg | Set | Sta | Alg | Set | Set | Ari | Geo | Sta |
| Q - 6 | Alg | Ari | Geo | Sta | Ari | Geo | Geo | Sta | Set | Geo | Ari | Ari | Geo | Alg | Sta |
| | Sta | Set | Ari | Ari | Geo | Ari | Alg | Ari | Alg | Ari | Alg | Sta | Ari | Geo | Geo |
| | Geo | Sta | Alg | Geo | Sta | Set | Ari | Alg | Ari | Set | Geo | Set | Alg | Sta | Ari |
| | Ari | Geo | Set | Alg | Set | Alg | Sta | Geo | Geo | Sta | Set | Alg | Sta | Set | Alg |
| | Set | Alg | Sta | Set | Alg | Sta | Set | Set | Sta | Alg | Sta | Geo | Set | Ari | Set |
| Q - 7 | Geo | Ari | Ari | Alg | Sta | Ari | Geo | Geo | Geo | Sta | Alg | Ari | Geo | Ari | Set |
| | Alg | Geo | Sta | Geo | Ari | Geo | Alg | Ari | Ari | Set | Ari | Alg | Ari | Geo | Sta |
| | Ari | Sta | Alg | Ari | Geo | Set | Ari | Sta | Alg | Ari | Geo | Geo | Alg | Sta | Alg |
| | Set | Alg | Geo | Sta | Set | Sta | Set | Alg | Set | Geo | Sta | Sta | Set | Alg | Ari |
| | Sta | Set | Set | Set | Alg | Alg | Sta | Set | Sta | Alg | Set | Set | Sta | Set | Geo |

Ari = Arithmetic

Alg = Algebra

Geo = Geometry

Sta = Statistics

Appendix - 8

Statistical Formulas used for the Analysis of Data

1. a) Difficulty Level (P) = $\frac{R_U + R_L}{N_U + N_L} \times 100\%$

b) Discrimination Index (D) = $\frac{R_U - R_L}{\frac{1}{2}(N_U + N_L)}$

Where,

R_U = Correct Responses in Upper 27% of Students

R_L = Correct Responses in Lower 27% of Students

N_U = Total No. of Students in Upper 27% of Students

N_L = Total No. of Students in Lower 27% Students

2. Reliability Co-efficient (r) = $2 \left(1 - \frac{sd_o^2 + sd_e^2}{sd_t^2} \right)$

Where,

Sd_o = Standard Deviation of the scores awarded for odd items

Sd_e = Standard Deviation of the scores awarded for even items

Sd_t = Standard Deviation of the total scores

3. Mean (\bar{X}) = $\frac{\sum X}{N}$

4. Standard Deviation (sd) = $\sqrt{\frac{\sum (X - \bar{X})^2}{N}}$

5. Variance (S^2) = $\frac{\sum (X - \bar{X})^2}{N}$

6. Chi-Square (χ^2) = $\sum_{i=1}^5 \frac{(O_i - E_i)^2}{E_i}$

Where,

O_i = No. of students obtaining the scores in a certain group from different units

E_i = No. of students obtaining the scores in a certain group from the total contents