ANALYSIS OF MATHEMATICS CURRICULUM AT SECONDARY SCHOOL LEVEL IN PAKISTAN

By

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(51/FUCE/Ph.D.Ed-2004)

FOUNDATION UNIVERSITY
COLLEGE OF LIBERAL ARTS AND SCIENCES
ISLAMABAD-PAKISTAN
2010
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A thesis submitted for partial fulfillment of
the requirements of the degree of
Doctor of Philosophy in Education

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COLLEGE OF LIBERAL ARTS AND SCIENCES
ISLAMABAD-PAKISTANI
2010
In the name of Allah,
The Beneficent, the merciful.
Dedication

This humble piece of research work is dedicated

To

My Parents,

Whose prayers and affections were source of strength in my life
FORWARDING SHEET

This thesis entitled “Analysis of Mathematics curriculum at secondary school level in Pakistan” submitted by Muhammad Arif in partial fulfillment of the requirements of the degree of Doctor of Philosophy in Education” under my guidance and supervision is forwarded for further necessary action.

Dr. Rabia Tabassum
Advisor
This thesis entitled, “ANALYSIS OF MATHEMATICS CURRICULUM AT SECONDARY SCHOOL LEVEL IN PAKISTAN submitted by Muhammad Arif in partial fulfillment of the requirements of the degree of “Doctor of Philosophy in Education” is hereby accepted.

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AUTHOR’S DECLARATION

Except where otherwise acknowledged in the text, this thesis represents the original research of the author. The material contained herein has not been submitted either whole or in parts, for a degree at this or any other university.

Muhammad Arif
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Praise and glory be to ALLAH (SWT) whose blessings are unlimited, Who created us, Who enlightened our minds and hearts with the knowledge and enabled the researcher to accomplish this research work. Blessings of ALLAH (SWT) be upon the Holy Prophet Muhammad (P.B.U.H) who guided the humanity to the right and bright path.

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(MUHAMMAD ARIF)
ABSTRACT

The curriculum being the main instrument of education can not be static. As the frontiers of knowledge expand with time, the curriculum should be updated and restructured to enhance the quality and standard of education. Curriculum analysis and change has been a burning issue in Pakistan during the recent past. The present study was designed to analyze the curriculum of mathematics for class 9th prescribed by the Punjab Text Book Board Lahore.

The major objectives of the study were: 1) to analyze the policy objectives of the Mathematics curriculum at secondary school level in Pakistan, 2) to analyze Mathematics curriculum process with special reference to objectives, content, methodology and evaluation, 3) to critically review the subject matter of the Mathematics in order to point out the strengths and weaknesses at Secondary school level in Pakistan, 4) to explore the opinion of the curriculum experts about the worth of Mathematics Curriculum at secondary school level in Pakistan, and 5) to suggest measures for the improvement of secondary school Mathematics curriculum in Pakistan.

Population included all the experts of national curriculum in the subject of Mathematics working in the Ministry of Education Islamabad, Curriculum Bureau in Provinces and working teachers of the Mathematics at secondary school level in Pakistan. One thousand and eighty mathematics teachers from 540 secondary school of Punjab were randomly selected, whereas 30 curriculum experts/educationists were contacted for their opinion. A questionnaire for teachers and an interview schedule for experts were used to collect data. Data was collected personally as well as through contacts and mail. Percentage and Chi Square test were used for statistical treatment of the data. The study
was delimited to mathematics curriculum of 9th class and the teachers were selected from the public secondary schools of Punjab province only. The opinion, suggestions made by the respondents were tabulated and analyzed. Discussion, conclusions and recommendations were given in the light of the findings of the study.
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Criteria for selection of activities is based upon:
Sufficiency of pictures, figures, and graphs
Language of text book is understandable
Script of book is free of errors
Mathematics concepts in the book are understandable
Difficult concepts are clearly explained in the book
Number of solved examples is sufficient
List of key words provided in the end
Index is provided in the end
Mathematics curriculum requires special teaching methodology
Mathematics curriculum is based upon single text book
Most suitable teaching method for mathematics
Teaching methodologies for mathematics curriculum are appropriate
with respect to
Demonstration models are presented to the students to explain difficult Concepts
Home work is regularly given to students
Home work given to students is checked regularly
Audio video aids are provided for teaching mathematics in the classroom
Students are interested in knowing the application of mathematics in daily life
Examination for Secondary school mathematics is based upon the items which test:
Pattern of the choice in the board’s mathematics paper is appropriate
Students are judged in academic year by variety of evaluation patterns
Internal system for testing mathematics curriculum is suitable in our environment
Students are able to write a set in the set builder notation
Students can verify the property of operation on set
Can verify the property of operation on set using Venn diagram
Students are able to write ordered pairs, Cartesian product and binary
Relations

49: Students Can define and write function and its kinds (into, onto, one-to-one, and Bijective)

50: Students can read and plot the points in the Cartesian product and know the fact that there is one to one correspondence between points on the plane and the ordered pairs represented by RxR

51: Students know and write properties of real numbers

52: Students have the concept of surds and can find the conjugate of surds

53: Students can evaluate the expression of the types of \( \frac{x^2+1}{x^2}, \frac{x^4+1}{x^4} \) where \( x \) is a surd by rationalization

54: Students can know the laws of exponents of real numbers and can apply them in simplification of the expressions containing them

55: Students can write numbers in scientific notation

56: Students have the concepts of log and anti log, can write the characteristics and mantissa and can find its anti log

57: Students can prove the laws of logarithms and apply them in computation of simple and harder problems

58: Students can solve harder cases of division of algebraic expressions

59: Students can establish and apply the following formulae:

60: Students can factorize the following types of expressions

61: Students can find the HCF, and LCM of algebraic expression

62: Students can simplify the algebraic expressions

63: Students can find the square roots of algebraic expressions

64: Students can learn the concept of a matrix, its rows, columns, order and types of matrices

65: Students can add, subtract, and multiply matrices, know that the multiplication of matrices is associative but not commutative in general

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CHAPTER 1

INTRODUCTION

It is no more rhetoric but a time tested reality that destiny of nations is shaped in classrooms as well as in social settings through education. It has been well recognized that education is an important ingredient for the development of an individual, society and nation. The main contribution of education to the individual is the basic-right type of attitudes, values, adequate knowledge, and essential skills. It is true that these basics can only be provided through a sound educational system.

Science like mathematics has earned an important status, emerging as a powerful force for socio-economic changes and development of the nation. It deals with identifying problems, searching explanations and seeking solutions for the welfare and advancement of the society. Therefore, it becomes imperative to direct the youth towards science education, especially mathematics education. Courses of the science subjects should be designed in such a way that every pupil should be given an opportunity appropriate to the needs and potentials of individuals as well as of the country. (Govt. of Pakistan, 1991)

Pakistan is a developing country and is continuously striving for a respectable status in the community of nations. Pakistan needs a sound base of science and technology to solve its problems of food and shelter, fuel and energy, health and security, exploitation of natural resources and boosting of agricultural and industrial production. Pakistan has established itself as a member of global nuclear power society (Iqbal, 1990).

The advancement of science and technology is entirely influenced by the research
and development in the field of science especially Mathematics being the mother of all sciences.

Pakistan is far behind from the developed countries, especially in the field of science including Mathematics. So to cope with challenges of the new era and globalization there is a definite need to update our curricula according to the recent developments and concepts to make it in consonance with the emerging needs. Research activities in our country are mainly focused on natural sciences and agriculture. Unfortunately, Mathematics which is a quiet important field is being ignored and there is a dire need to put some efforts into this area of knowledge. Venkataiah (1993) holds that the curriculum being the main instrument of education, it can not be static. As the frontiers of knowledge expand with time, the curriculum should be updated, restructured in such a way that it would enhance the quality and standard of education. Thus innovations in curriculum become inevitable, with the changes that take place in the society.

The curriculum of mathematics had been revised no of time since 1947. It was revised in 1968 and sets were introduced at grade 9th and 10th level. As a result of their revision major changes in subject matter and text books were carried out. Therefore this revision of curriculum was named as modernization of mathematics curriculum. In 1972, 73 mathematics curriculum was again revised to make the content concept oriented. Inductive and deductive approaches were introduced. The revised draft was implemented from 1979. In 1986 it was again tried to revamp the mathematics curriculum but the effort ended with few minor changes.
A major breakthrough in the history of development of mathematic curriculum for secondary school level was initiated in the year 1994, when a unified curriculum was developed for science as well as arts students. A new chapter information handling was added with the existing parts like Set, Numbers, Algebra, Geometry and Trigonometry. But the element of shortage of teachers in the schools was neglected at the time of implementation of this curriculum in 1995.

Tahir (1997) evaluating this curriculum opened that major portion of this new curriculum was a copy of the previous one that was in practice for elective groups students. Teachers teaching arts group were compelled to teach this new curriculum without any refresher course. The shortage of teacher in female schools was neglected.

In December 1999 a task force was established by Govt. of the Punjab Education Department to modernize curriculum so that the new curriculum was in accord with developed world in content and approach. The initial draft of the curriculum was developed by the task force of the Punjab Education Department (PED) and then sent for comments to other Provinces and Federal Government. After approval this curriculum was implemented from the academic year 2003.

(Govt. of Pakistan, 1968, 1972 and 1994).

Curriculum development and analysis is a sensitive issue in education especially in the context of ideological society seeking and striving for technological development like Pakistan. Mathematics due to its utilities has become an inevitable course of school life all over the world. But what a great misfortune with such a significant subject is that the majority of school going population is afraid of it. Why is this dread of mathematics? Whether, it is due to curriculum, textbook or methodologies of the teachers. Students who
are bright and shining in almost all other subjects of their study should not be blamed for this discrepancy. Most of the responsibilities lie on curriculum developers and teacher’s methodology. Unfortunately we did not pay attention towards the development of mathematics curriculum in the past. No serious research work had been done towards this basic aspect of education. This state of affairs compelled the researcher to conduct this study to fill the gap.

1.1 STATEMENT OF THE PROBLEM

This study was designed to analyze the mathematics curriculum at secondary school level in Pakistan prescribed by the Punjab Text Book Board Lahore.

1.2 OBJECTIVES OF THE STUDY

The major objectives of the study were:

1. To analyze the policy objectives of the Mathematics curriculum at secondary school level in Pakistan.

2. To analyze Mathematics curriculum process with special reference to:

   a. Objectives
   
   b. Content
   
   c. Methodology
   
   d. Evaluation

3. To critically review the subject matter of the Mathematics curriculum in order to point out the weaknesses at Secondary school level in Pakistan.

4. To explore the opinion of the curriculum experts/educationists about the worth of Mathematics Curriculum at secondary school level in Pakistan.
5. To suggest measures for the improvement of secondary school Mathematics curriculum in Pakistan.

1.3 SIGNIFICANCE OF THE STUDY

Mathematics is a general, useful subject so a participating component of our society should be familiar with the fundamental mathematics. Mathematics also has a extra particular, obscure, and artistic side. It optimizes the splendor and supremacy of mathematical logic. Mathematics embodies the hard work made over thousands of years by each culture to understand natural world and regulate to human dealings (Anwar, 2004).

More mathematics has been created since the end of the World War II than in all pervious human history. Today, knowledge of mathematics is one of components that separate people who have choices from people without choices. The computer revolt has made mathematics a more vital element of insurance industry, medical research, government transportation, manufacturing and construction. Mathematical literacy leads to muddled personal decisions and mis-informed government policies. Children born today will enter a work force where knowledge of mathematics is crucial to their career opportunities, their contribution in the world, and the performance of their personal lives. Any individual who does not have a expansive perception of mathematics will have inadequate professional opportunities (Johnson and Johnson, 1991).

The present study will bring a significant informational foundation for the curriculum designers and planners to take it in synchronization with the national demands and ambitions. It will highlight the weaknesses and strengths of the Mathematics
curriculum at secondary school level in Pakistan. Moreover, appropriate actions for the perfection of the said curriculum will also be provided through the findings of the study.

It would also help the teachers and educational planners for the advancement of secondary school mathematics education. Future researchers would use this study as a launching pad to explore the worth and condition for mathematics education in Pakistan.

1.4 METHODOLOGY

Research is the process of generating knowledge and finding the reality and truth. This research aimed to analyze the national mathematics curriculum at secondary school level in Pakistan. Various measures were taken by the researcher to explore the objectives of this study.

This study was descriptive in design and extensive literature review was carried out to understand the previous related studies on the topic.

1.4.1 Population

Population for this study constituted all the experts of National Curriculum in the subject of Mathematics working in the Ministry of Education Islamabad, Curriculum Bureau in Provinces and working teachers of the Mathematics at secondary school level in Pakistan.

1.4.2 Sample

Random and convenient sampling techniques were used for the selection of experts and mathematics teachers at secondary school level. Distribution of the experts is as under

1. Curriculum experts working in universities and curriculum wing
2. Research Officers of BISEs 05

3. Curriculum experts from Punjab Textbook Board 05

4. One thousand and eighty Mathematics teachers from 540 schools (two teachers from each school) of Punjab province were selected randomly as sample of this study.

1.4.3 Research Instruments

To collect data, following research instruments were developed and administered

a. Questionnaire for teachers (Annex A)

b. Interview schedule for curriculum experts/educationists (Annex B)

1.4.4 Data Collection

Data was collected through the administration of researcher made questionnaire for the teachers and interview schedule for the experts of Mathematics education separately.

1.4.5 Data Analysis

Collected data were analyzed quantitatively by using percentage and Chi Square test.

1.5 DELIMITATIONS

Due to limited time and resources, the study was delimited to:

1. Mathematics curriculum of 9th class.

2. Punjab province.

3. Public School Teachers teaching the subject of Mathematics at secondary school level.
CHAPTER 2

REVIEW OF RELATED LITERATURE

This chapter deals with the appraisal of connected literature and the discussion has been divided into the following five sections:

i. Curriculum

ii. Secondary Education

iii. Text book

iv. Mathematics Education

v. Research Studies about the curriculum analysis

2.1 CONCEPT OF CURRICULUM

Derek Rowntree (1981) defined curriculum as "Curriculum can refer to the total structure of ideas and activities, developed by an Educational institution to meet the needs of students and to achieve desired educational aims”.

Skilbeck (1984) defined the curriculum as, “Learning experiences of students, in so far as they are expresses or anticipated in goals and objectives, plans and designs for learning and the implementation of these plans and design in school environments.”

Wiles and Bondi (1989) are of the view that the curriculum is a goal or set of values which are activated through a development process culminating in classroom experiences for students. The degree to which those experiences are a true representation of the envisioned goal or goals is a direct function of the effectiveness of the curriculum development efforts.
In the words of Beck and Cook (2003), “Curriculum is the sum of the educational experiences that children have in school”.

To sum up, it may be said that all those activities taking place inside or outside the educational institute for the purpose of learning of the students under the supervision of a guide is curriculum.

2.2 CURRICULUM PLANNING

Curriculum planning has been defined in various ways:

- Curriculum planning is a process in which participants at many levels make decisions about what the purpose of learning ought to be, how those purposes might be carried out through teaching-learning situations and whether the purposes and means are both appropriate and effective.
- Curriculum planning consists of all the processes necessary to plan for and write a curriculum.
- Curriculum planning is the process of gathering, sorting, selecting, balancing, and synthesizing relevant information from many sources in order to design those experiences that will assist learners in attaining the goals of the curriculum.
- Curriculum planning is the orderly study and improvement of schooling in the light of stated objectives.
- Curriculum planning is the preliminary phase of curriculum development when the curriculum workers make decisions and take action to establish the plan that teachers and students carry out.
- Curriculum planning is the process whereby arrangements of learning opportunities or curriculum plans are created. (Shahid, 2005)
2.3 CHARACTERISTICS OF CURRICULUM PLANNING

These may be stated as:

1. Curriculum planning is ultimately with the experiences of the learners.
2. Curriculum planning involves decisions about both content and planning.
3. Curriculum planning involves decisions about a variety of issues.
4. Curriculum planning involves many groups.
5. Curriculum planning takes place at many levels.
6. Curriculum planning is a continuous process.

2.4 PROCESS OF CURRICULUM DEVELOPMENT

The process of curriculum development begins with the following:

- Formulation of objectives of education, which are based on the ultimate, aims of life, and also on the political and social philosophy and development needs of a country.
- Educational objectives in respect of different stages of school education and also in respect of different subjects and activities and experiences at different stages of education.
- Determination of the scheme of studies, syllabi, etc.
- Preparation of instruction materials like textbooks, supplementary readers, workbooks, and teachers guides, etc.
- Implementation of curriculum in the school.
- Evaluation of curriculum to ensure quality control for suitable modifications in the curriculum.
2.5 STEPS IN CURRICULUM DEVELOPMENT PROCESS

Curriculum development process consists of various phases or elements. The curriculum planners have to consider all these phases while working on such process. According to Farranta, J. S. (1990, p. 24) the elements of curriculum development are philosophy, society, aims, educational administrators, school organization, teaching material, teacher’s role and teaching methods.

In the words of Lawton, D. (1976, p. 24) the elements of curriculum are the goals, objectives, content, processes, resources, and means of evaluation.

Wheeler (1974, p. 30) has identified the following elements of curriculum. The first element is the formulation of objectives and goals. Then formulation of learning experiences to achieve the above selected objectives. Content selection is the third element of curriculum. The organization and integration of learning experiences and subject matter related to school is the last element of curriculum.

In the light of above mentioned elements and taking into consideration the educational system in Pakistan, curriculum must have the following important basic factors:

(a) Situational analysis
(b) Setting the objectives
(c) Selection of Content
(d) Selection of Learning experiences
(e) Evaluation
2.5.1 Situation Analysis

A situation analysis is most likely to be made at quite a deep level as a preliminary to curriculum planning, again, but less deeply, during development work as a check, again at the point of implementation of the new curriculum.

Nicholls and Nicholls (1974) refer to the process of situation analysis as, “A situation which is made up of a number of factors such as pupils, pupils’ home and background, school, its climate, its staff, facilities and equipment. Analysis of these factors, together with a self analysis, followed by study of their implications for curriculum planning constituted one step towards the rational approach of curriculum”.

Curriculum development is not an activity which is undertaken once in a school and then is finished. Rather, it is a continuous process, with knowledge and insights derived from assessment being feedback and providing a fresh starting – point for further development. The curriculum itself should be regarded as dynamic rather than static and one of the most important roles of the teacher is to make decisions about a whole range of factors. Each teacher finds himself in a situation, which is made up of a number of factors. A situation analysis is most likely to be made at quite a deep level as a preliminary to curriculum planning, again, but less deeply, during development work as a check, again at the point of implementation of the new curriculum (particularly if some of the factors have changed by that time, which might well be the case if curriculum planning has taken a long time), and finally during consideration of the steps to be taken as a consequence of assessment (Nicholls & Nicholls, 1974).

The need for conducting a situational analysis is fundamental precept of effective curriculum development. Developers commencing their task should ask important questions such as, what do we know about the context – the students, teachers, school
environment – of this curriculum and why is it needed? This provides them with an information base to pose an even more fundamental question: what do our learners need?

A situation analysis is an obvious commencement point for the construction of a curriculum. It is an ideal opportunity for curriculum developers, aware of the curriculum presage factors affecting them, to bring a reasoned, rational approach to the development of curricula. Above all, it is an opportunity for curriculum developers to take account of local factors when developing curriculum to meet student needs (Print, 1993).

A recommended approach for conducting a situational analysis involves four steps: i) identify problems in contents; ii) select approach factors; iii) data collection; and analysis iv) make recommendations.

Identify problems in context
\[ \downarrow \]
Select appropriate factors
\[ \downarrow \]
Data collection and analysis
\[ \downarrow \]
Make recommendation


**Figure 1: Situation analysis procedure**

In Lawton model, the situation analysis can be explained on the basis of philosophical theories and sociological theories. A selection from culture, psychological theories, and organization of curriculum in terms of sequence and stages.

In philosophical theories, there will be philosophical ideas about the aims of education and the structure of knowledge which lies behind any curriculum design. These
are not always made explicit; therefore, we may have to examine the curriculum carefully to see what is implied.

The sociologists of knowledge have something to say about the arguments which philosophers put forward with respect to knowledge. In addition sociologists also have to say about the nature of society and issues of social, technological and ideological change. The curriculum design factor will also influence the curriculum design.

Likewise, the curriculum designer makes some selection from the culture; a choice is made about what children ought to learn. It may be determined that there is some common core of knowledge, skills and values which are children, ought to study.

Having decided what students should ideally learn, the curriculum designer consults the psychologists to reconsider the ideals in terms of theories of learning. Different theorists may offer a range of issues to consider in terms of structuring and sequencing. The programme suits their notions about the child’s developmental stages or learning processes. Theories of learning are insufficient without complementary theories of teaching.

Finally, a curriculum is constructed and the practical problems of its implementation have to be dealt with in most cases it has to fit into certain time limitations, and resources, both human and material are required to teach it to work through a curriculum, one has to think like a philosopher, a sociologist, a psychologist, and a curriculum designer. The value of using of different ways of thinking about curriculum situation analysis in that one can obtain a variety of different perspectives and gain a range of insights about the process of curriculum. (Rashid, 1997).
2.5.2 Curriculum Objectives

Lewy (1977) has pointed out that the selection of objectives is a matter of choice, and therefore must be considered as representing the value judgments of those responsible for the schools. Nevertheless, the selection of curriculum objectives can be facilitated by certain considerations.

- Contemporary life outside the school.
- Manpower employment patterns.
- New behavior requirements in welfare, politics and social activities.
- The needs of the learner.
- Subject matter.

Aims, goals and objectives

Curriculum intent

Aims

Goals

General /Unit

Specific /instructional

Source: Print (1993)

Figure 2: Aims, goals and objectives

One of the major difficulties of curriculum process is the transition from general aims to the particular objectives of the classroom. Whether the aims of the educational process are stated as part of the curricular process, or, as is more usual, in isolation from
it, they are of little use in the day-to-day learning’s situations in classroom or school (Rashid, 2000).

A useful way to think about educational aims is to consider them as statement of societal expectations and desires. More particularly, aims are broadly phrased statements of educational intent aims states what is to be hopefully achieved by the curriculum. They are purposely stated generally because they are developed for a general level of education and by society. Mostly aims are considered to be developed at a system level such as an education department or system. Aims are long term in nature and may cover a time span of many years, even the entire school life of a child.

Goals are more specific, precisely worked statements of curriculum intent and are derived from aims, usually phrased in non-technical language, goals are directed towards student achievement by emphasizing content and skills. Another way to conceptualize goals is to consider them as the ways institutions and organizations within society facilities the achievement of educational aims. That is, if an aim of an education system is to make students literate and numerate, then goals are the ways by which educational institutions generally address those aims. Curriculum developers often devise goals, as do others working at higher levels of curriculum development such as subject syllabus committees. Goals, medium to long term depending upon how they have been translated from aims.

The statement of goals embraces teacher and pupil actions including a statement of the kinds of learning outcomes, which are anticipated. Goals ‘derive’ from the situation analyzed only in the sense that they represent decisions to modify that situation in certain respects and judgment about the principal ways in which these modifications
will occur. That is, goals imply and state preferences, values judgments about the directions in which educational activities might go (Print, 1993).

Objectives are invariably devised by teachers, or groups of teachers, for use within the school, or groups of educators within an institution. They are short term in nature and, as such, may cover a lesson, a day, a week, a term or a semester (Print, 1993).

2.5.2.1 The Classification of Objectives

Several attempts have been made to develop a classification scheme for education objectives. These classification schemes have served, apart from anything else, as a tool for examining the balance of the curricular objectives of a particular programme. The most widely used classification scheme is known as the Taxonomy of educational objectives, in which three domains are identified: (i) the cognitive; (ii) the affective and (iii) the psychomotor. Those categories within each domain which frequently appear in the framework of curriculum development will be mentioned here.

a) The cognitive domain

According to present teaching practice, most educational objectives are of a cognitive nature; the cognitive taxonomy has become the most widely used. The six major categories of the taxonomy are frequently clustered into two groups: lower mental functions and higher mental functions (Bloom et al., 1956).

1. Knowledge: the recall of information. A specific fact of a generalization may constitute the information recalled. It should be emphasized that knowledge means recall only, and not application of the information in a particular situation.

2. Comprehension: understanding of the message of a communication and the ability to explain or summarize it.
3. Application: the ability to use a principle rule or method in a concerted situation.

4. Analysis: the ability to break down a communication into its constituent elements and ability to clarify its content.

5. Synthesis: the ability to combine elements so as to form a whole. This category contains the notion of creativity, which has in recent years been strongly emphasized as worthwhile educational objectives.

6. Evaluation: Judging the value of material and methods for given purpose.

b) The affective domain

Affective objective emphasizes feelings, emotions and the degree of acceptance or rejection of given phenomenon. These objectives occupy limited space in the more traditional sets of curricular objectives, but their importance is now becoming more widely recognized. Attitudes, values and interests are types of affective behaviors (Krathwohl et al., 1964).

Only the first three categories of this domain are mentioned here, because only they appear frequently in the formally stated lists of curricular objective.

1. Receiving (attending): This category is concerned with being aware of the existence of certain phenomena and revealing willingness to tolerate a stimulus. Thus, for example, being aware of the existence of classical music and being able to differentiate it from music of other types of constitutes an example of receiving.

2. Responding: This is more than merely being aware of a phenomenon. It means active participation, such as going to a concert of classical music or purposefully listening to a classical record.
3. Valuing: Behavior categorized at this level is stable and consistent. Thus a
sustained interest in classical music, repeated visits to concerts, etc constitute
signs of valuing classical music.

c) **The psychomotor domain**

Several objectives related to the acquisition of practical skills and habits appear in
a number of curriculum areas, for example, practical and laboratory work in science
subject; work experience as a part of extended general education; handicrafts;
psychomotor components of reading and writing, etc. A classification scheme of
psychomotor skills has been developed by Dave (1969). The scheme is based on the
concept of co-ordination between psychic and muscular actions and between different
muscular actions performed by various parts of the body. The five categories of the
scheme are listed below:

1. **Imitation**: Activities which do not require muscular co-ordination.
2. **Manipulation**: Following directions, acting according to instructions.
3. **Precision**: The ability to increase speed of action, and to introduce modifications
   according to specific needs of a particular situation.
4. **Articulation**: Co-ordination of series of acts by establishing appropriate sequence,
   developing efficiency to perform a number of related acts simultaneously and
   sequentially.
5. **Naturalization**: Reutilizing the act to such an extent that it results in automatic and
   spontaneous response.

**2.5.2.2 Criteria for development of curriculum objectives**

Pratt (1980) described that there are seven main criteria that curriculum objectives
should meet. Three of them - outcome specification, consistency, and precision - have to
do with the derivation and specification of objectives. Four -feasibility, functionality significance and appropriateness - relate to the value of objectives. The major characteristics of objectives are as under:-

a) **Objectives should identify a learning outcome**

   An objective is, by definition, an intended learning (or training) outcome of a curriculum. Objective that begins with “the student will study” or “the student will learn about”, usually refer to the student's means of single behaviors, such as the student will write one page, or the student will demonstrate refer not to outcomes but to performance criteria.

b) **Objectives should be consistent with the curriculum aims**

   Objectives should conform to the aim from which they are derived. In much the same way, "value clarification" and "critical thinking" tend to be promiscuously claimed as objectives by history, social studies, English, and health education courses. If an objective meets the other criteria but is not consonant with the curriculum aim, there are two paths of action open: change the aim, or include the objective in a more suitable curriculum.

c) **Objectives should be precise**

   Objectives are useful only if they are sufficiently precise that different people obtain from them the same understanding of the intended learning outcome. Students will observe intelligent health practices, for example, is so vague and ambiguous that its usefulness is severely limited.
d) **Objectives should be feasible**

Unfeasible objectives are relatively rare. Most curricula—probably more than 99 percent—are aiming at objectives that are known to have been achieved through other curricula, and are therefore feasible in principle. In selecting objectives, designers tend to be unduly timid rather than the reverse, maintaining somewhat low expectations of what can be accomplished. For this reason, of the seven criteria this is the one least frequently violated.

e) **Objectives should be functional**

Objectives should be personally and socially functional. An objective is personally functional if its attainment is likely to benefit the learner at once or in the future. It is socially functional if it benefits people other than the learner.

f) **Objectives should be significant**

It is not hard to make a case for the functionality of almost any objective. Objectives must be selected according to criteria of relative value. The criterion of significance requires that every objective selected be of greater value than any alternative objective that could be, but is not being, pursued in the curriculum.

g) **Objectives should be appropriate**

An objective may be functional and significant in principle and yet be inappropriate in a given curriculum. Appropriateness is primarily significance for particular learners, which is affected by such factors as the learner's background, interests, and the development level.

2.5.3 **The Content Selection**

Content or subject matter occupies an important place in the curriculum. It provides the means for achieving the goals of education, a means for organizing the
activities and experiences required by the child to have a gainful understanding of the world in which he lives. The knowledge or the content is the stock in trade of the school since times immemorial. Knowledge or wisdom comprises various disciplines or subject. The scope of each subject changes according to the conception of mankind of its purposes. In the early days of pedagogy there was not much knowledge to be imparted and the scope of the content in each subject was very meager. The areas of knowledge is to get accumulated and multiplied leading to many divisions and branches. Thus we have Natural Sciences, Physical Sciences, Humanities, and Social Sciences which were further branches into many other fields of learning or disciplines. This growth or multiplication of subjects is taking place in the modern period with much quicker space than in the earlier days. This feature is affecting the school curriculum with regard to the selection of the content for the purpose of including it in the school curriculum (Nisbet, 1973).

Content might be described as the knowledge, skills, attitudes and values to be learned. An important consideration about content is its close relationship with method. The method used often has as much influence on what the pupils learn as does the content. For instance, in trying to change pupils attitudes teachers might find group discussion technique more useful than direct class technique. Content is valid when it is authentic and true. The main problem is that of adjustment to the abilities of the pupils. Content must be available in forms which are appropriate to the pupils. It is also important that what is to be learned makes a connection with something, which the pupils have already learned. Content must be considered in relation to the objectives (Nicholls and Nicholls, 1983).

Many people involved with curriculum development, including many teachers in schools, believe that the starting point for constructing a curriculum lies with the
formulation of content. This appears to be a natural phenomenon as the teaching of content is the daily fare of teachers in schools. Consequently many teachers tend to think in terms of what content students should learn and what content is of value to learners when they begin to plan for curriculum development (Print, 1993).

Learning opportunities, learning activities, learning experiences, teaching learning strategies and method are terms frequently used interchangeably to explain what the teacher does to facilitate learning within the student. That is how the teacher imparts content and provides opportunities for learner acquire that content.

2.5.3.1 Criteria for selecting the content

Smith et al. (1957) have suggested the following criteria for the selection of the content:

a) **Significance to an organized field of knowledge**

The content in the subject matter should belong to the broad areas of knowledge for the purpose providing broader basis of understanding of the world. Since the school curriculum should also deal with the specialization as well as broad areas of knowledge, there should be general areas of knowledge and core curriculum with specialized knowledge (Mamidi and Ravishankar, 1986).

Therefore, the curriculum should consist of a number of carefully selected principles, ideas and concepts, which constitute the basic core of a subject matter.

b) **Does the subject matter stand the test of survival?**

The status of knowledge also needs to be considered while selecting the content. The information which is tested and tried and which can be applied to the present day situation only should be selected. According to Hilda Taba (1962) the knowledge should be valid and significant to the extent that it reflects the contemporary scientific
knowledge. The information should also stand the test of survival. Such useful information should be identified and included in the curriculum.

c) Utility of the subject content

The content of the curriculum has often become the target of severe criticism by one and all in the society. It is mostly criticized for the heavy load of information which has no relevance to the pupils, for deadwood of information which has no utility, which is full of facts, dry and arid, the learning of which encourages rote memorization or cramming, without leaving any scope for intelligent reasoning.

Dewey (1916) in “democracy and education” severely criticized this type of information or dry knowledge offered in the traditional Schools. Knowledge the definitions, rules, formulae etc is like knowing the names of parts of a machine, without knowing what their function is. According to him, such information is not based upon understanding the interpretation, and because it does not involve application in a variety of new situations, it is readily forgotten. To Dewey knowledge consists of what we consciously do or make use of in understanding what is happening in straightening out a perplexity, by conceiving a connection between ourselves and the world in which we live.

d) Interest and ability

One should also consider factors like interest, aptitudes and abilities of pupils while selecting the content. Unless the content is interesting to the pupils, there will not be any learning at all. Interest depends upon the aptitudes and grasping capacity of the pupils. It is again a matter of age and intelligence of the pupils. The theories of learning and intelligence in educational psychology throw much light on the factors that develop
interest among the pupils. Selection of content – suitable to the understanding capacity of the pupils – will result in efficient learning.

e) Growth and development of a democratic society

This concept also includes social development and assumes that the social change, which is taking place very rapidly, should be controlled and directed towards desirable directions. A careful selection of the content that can build knowledge and abilities is required to deal intelligently with the problems associated with social change. This includes controlling the development of fissiparous tendencies among the pupils and other antisocial behaviour that creates chaos and confusion in the society, and development of social values among pupils.

2.5.4 Selection of Learning Experiences (Methods)

Methods of teaching are the source of achieving the desired objectives. Without an effective teaching method curriculum and the most perfect syllabus remains ineffective.

In the cycle of the curriculum process, learning activities are integrally related to content and curriculum intent. Just as content is derived from statements of aims, goals and objectives, so curriculum developers seek to implement that content effectively through the use of appropriate learning activities. In this way the various methods not only teach the content but also help in achieving the initially stated objectives.

When considering a variety of teaching methods once should also distinguish between different categories as well as within the same category in order to locate the most appropriate strategies. The principal grouping of teaching – learning strategies are

i) Expository teaching

ii) Interactive teaching
iii) Small group teaching/discussion
iv) Inquiry teaching/problem solving individual
v) Inductive- deductive method (Print, 1993).

The teacher is the key to improve schooling. Ideally, teachers should possess a broad knowledge of their subjects, good classroom management and pedagogical skills, and the motivation to help their pupils learn and succeed. Unfortunately, many teachers do not possess such qualities; teachers are also the products of over-extended and under-supported school system. They learned in the same overcrowded and under-supplied classrooms in which they are teaching, so it is likely that they will use the same teaching methods to which they were exposed in school (Rao, 1996).

2.5.5 Evaluation

Evaluation is a complex process concerned with the appropriateness and suitability of curriculum objectives and the sequence in which they are presented; with the delivery of the curriculum in the classroom in terms of content and learning experience, and with the progress in learning established by the pupil (Brennan, 1988).

Evaluation is concerned more fundamentally with deciding on the value or worth of a learning process as well as effectiveness with which it is being carried out (Gordon, 1981).

It is clear and there does not seem to be any disagreement on it, that because evaluation implies a comparison of what is to be evaluated with something which may be considered as a criterion, i.e. an ideal state, an acceptable behavior, an anticipated behavior, an intended result or goal, etc., there will be a need for collecting all relevant information on both the exact state of the object for evaluation and the criteria to be used for comparison (Farooq, 1994).
Downie (1961) while explaining the concept of evaluation describes the purposes of evaluation as:

- To provide information for grading, reporting to parents, and promoting students.
- To evaluate the effectiveness of a single teaching method or to appraise the relative worth of several methods.
- To motivate the student.
- To evaluate the entire educational institution and to show how several of its aspects could be improved.
- To provide information for effective educational and vocational counseling.

Curriculum evaluation differs from other kinds of educational evaluation. It focuses upon how teacher and student interact over a particular curriculum or syllabus. Curriculum evaluation involves an examination of the goals, rationale and structure of a teacher curriculum, a study of the context in which the interaction with students occur and an analysis of the interest, motivation and achievement, of the students experiencing a particular curriculum (Marsh, 1986).

There is another point of view from which evaluation as a part of curriculum – planning must be considered. In so far as it is an attempt to change behaviour, education is concerned with behaviour at what may be three different levels. First, there is initial behaviour, second is actual outcome. Finally, there are behaviours specified in the goals set out. They may be called intended outcomes (Rashid, 2000).

**2.5.5.1 Functions of evaluation**

i) They provide feedback to learner.

ii) Determine how well learners achieved the objectives.

iii) Provide information to improve curricula.
iv) Assist learners with decision making.

v) Clarify the stated objectives.

vi) Assist others in making decision about students.

Evaluation presage (Context)

Task specification (Purpose; and audience)

Evaluation design

Data Collection

Required data                Existing data

Data analysis

Conclusions and report      Presentation (Audience)

Source: Print (1993)

Figure 4: Curriculum evaluation algorithm

2.5.5.2 Types of evaluation

a) Formative evaluation

Formative evaluation is a type of evaluation that provides us information about the performance of the learner during the learning process. It is carried out to determine
the level of achievement of student’s progress to provide them with feedback on their performance.

b) Summative evaluation

This evaluation is aimed at broad judgment of the level to which the larger outcomes have been attained over the complete path or some considerable part of it. In summative evaluation we evaluate students at the end of a learning experience to indicate student achievement.

c) Diagnostic evaluation

"Diagnostic evaluation is directed towards for two purposes. i.e. placement of students properly at the outset of an instructional period (such as secondary school), or to discover the underlying causes of deficiencies in students learning as instruction unfold" (Print 1993).

d) Pupil evaluation

The pupil's evaluation according to Tuckman (1975) has the following uses in the process of learning and teaching.

- To give objectivity to the observations of a teacher.
- To elicit behavior under relatively controlled conditions.
- To sample the performance of which a student is capable.
- To determine performance and measure gains relevant to goals or standards.
- To apprehend the unseen.
- To detect the characteristics and components of behavior.
- To predict future behavior.
- To make data available for continuous feedback and decision making.
2.6 CURRICULUM DEVELOPMENT PROCESS IN PAKISTAN

The major issue of the Pakistan in 1947 was re-establishment of suitable education specimen. Federal government has brought a lot of changes in planning, policies, suggestions and reconstruction process of education. Some of these changes were accepted and some others were rejected. Ministry of Education has been supervising the curriculum and the text books. This special wing of Ministry of Education is called Curriculum Wing. There are bureaus and centers are following the instruction of curriculum wing in accordance with the succeeding forms.

2.7 BUREA OF CURRICULUM AND TEXT BOOK, MOE

The present curriculum wing of Ministry of Education is the advance form of National Bureau of Curriculum and Text Book. The purpose of this department is to evaluate and coordinate the work of education in different provinces. It also works for the equal standard of curriculum in schools, colleges and universities of all provinces.

The first function of curriculum wing is to help the government in construction and implementation of National Policies regarding planning of curriculum development, education of teachers and its evaluation. The next function of this wing is to give a hand in the activities of provincial bureau’s center. It also arranges researches on various types of curriculum. This wing is also helpful for guiding text books boards and authors in writing text books. This wing also keeps link with national educational institutions as well as international NGOs such as UNESCO, IBE, UNICEF, ILO.

2.8 MECHANISM FOR CURRICULUM DEVELOPMENT

Whenever there is a need to change and revise curriculum, the curriculum wing of Ministry of Education exceeds a proposal to the provincial curriculum centers. These centers are bound to revise the curriculum in accordance with criteria given by the
curriculum wing. Then subject committee including subject specialists are formed for the sake of consideration and revision of curriculum. The newly prepared draft is sent to curriculum wing for approval. Then curriculum of all subjects from all provincial centers is presented to national review committee. After approving it, this committee put up their draft to Education Secretary for notification. The approved curriculum is provided to text book boards for the publication of text books.

2.9 COMPOSITION OF CURRICULUM COMMITTEES

The committees are made by getting the list of nominated persons from the BISE, the provincial education department, the Text Book Boards and other research organizations such as The Institute of Education and Research, Lahore, Hyderabad, Peshawar, D. I. Khan etc. it is ensured that in this process experts play active role.

At provincial level, representative of Provincial Curriculum Center are involved. The participation of teachers, supervisors and Educational Administrators is also made possible in provincial committees. Subject specialists, representative of Text Book Boards and representatives of Boards of Intermediate and Secondary Education are also members of this committee.

At federal level representative of curriculum wing, foreign experts, committee leaders and parents also take active part in the committee of curriculum composition.

2.10 SECONDARY EDUCATION IN PAKISTAN

In determining the effectiveness of a national system of education, secondary education is universally recognized as an important stage. Developed countries and many of the European countries are concentrating all their attention on research and exploring better solutions to the ever-increasing problems faced by students at secondary school
level. Most of the people who compose the skilled manpower of a nation are trained before the end of their high school years. The quality of higher education is dependent upon the quality achieved at this stage. The formation of character and foundations of future leadership are laid during this stage. It is the time when the youth attains his formative adolescence stage (Ali, 1970).

2.10.1 Nature of Secondary Education

Secondary education in Pakistan, as in any other country, cannot profitably be studied unless the needs of the society and the child are fully assessed. In order to analyze the education provided at this stage, consideration must be given to the social and cultural values of individuals and to the development of potential talents. This would necessitate the recognition of national culture and sub cultures in which schools exist. Consideration must also be given to the nature of the learning process. Adequacy of an educational system can only be assessed when secondary education is viewed in a worldwide perspective. An educational system rapidly becomes obsolete and irrelevant to students needs unless administrative and instructional leaders keep abreast of the new trends and developments of secondary education in different sectors of the world (Farooq, 1994).

2.10.2 Objectives of Secondary Education

1 To make the Qur'anic principles and Islamic practices as an integral part of curricula so that the message of Holy Quran could be disseminated in the process of future generation of Pakistan as a true practicing Muslim who could be able to enter into 21st century with courage, confidence, wisdom and tolerance.
To ensure all the boys and girls, desirous of entering secondary education, get the basic rights because of the availability of the schools.

To develop the opportunities for technical and vocational education in the country for producing trained manpower, commensurate with needs of industry and economic development goals.

To improve the quality of technical education so as to enhance the chances of employment of technical and vocational education graduates by moving from a static, supply system to demand driven system (Ahmad, 1986).

2.11 TEXTBOOK

According to the Collins English Dictionary (1998), “textbook” is a book used as a standard source of information on a particular subject. While answering the question, “What is a textbook? Hamilton (1990) in “Paradigm - a Journal of the Textbook Colloquium” argues that a textbook may be any book or a book substitute, including hard-covered or paperback books, workbooks designed to be written in and used up, certain newspapers, news magazines and manuals which a student is required to use as a text or a text-substitute in a particular class or programme as a primary source of study material intended to implement a major part of the curriculum.

What constitutes a school text book is a debatable point of discussion in the literature. Questions have been raised such as whether the material in school and local library are text books or reference books. Similarly it can also be asked whether the novel that had been studied in different classes are text books or not. Warren’s (1981) answered to such questions by providing the definition, “a text books is printed instructional
material in bound form, the contents of which are properly organized. (p.43). (Kalmus, 2004) opines that text books are designed to teach students what their elders like them know.

From the above discussion we conclude that text book is the reflection of the decision taken by the curriculum developers.

2.11.1 Status of a Textbook in Curriculum

According to Farooq (1993), a textbook is a manual of instruction dealing with definite subject of study, systematically arranged intended for use of a special level of instruction and used as a principal source of study material for a given course. A true textbook is one specially prepared for the use of pupil and teacher in a class, presenting a course of study in a single subject, or closely related subject.

- A textbook is a valuable teaching aid, the servant of the teacher and the class.
- A textbook is a teacher of teachers.
- Facilitates review
- Provide basic learning material for the absentees.
- Gives orientation to the instructional program.
- Places acceptable reading material in the hands of the pupil who learns more effectively by sign rather than by sound.

According to Durrani (1997)“A text is not only a student’s aid but it is also the teachers’ tool, so a student should know that what he has to do with the text and a teacher should be given pedagogical points. So it is recommendable that student’s corner, and teachers points should be given in a textbook though there may be a separate work book a
teacher’s guide. There should be a separate fly leaf for the students to note additions or write diary.

2.11.2 Importance of Text Book in Education

According to Farooq 1993, “A textbook is the mostly common medium used by a classroom teacher. It has had almost the universal acceptance. A textbook presents the principles of a subject and is the basis of instruction. It is the foundation upon which you build; it is a spring board from which you dive into the world of thought and learning. Textbook is always a means of carrying forward into the future whatever insights and techniques have been found serviceable.

Textbooks have become very important because of the explosion of the knowledge. There is too much to learn. Textbooks provide the services of the experts in the form of concentrated, sifted and logically arranged knowledge which otherwise would not be possible by direct experiences. To be serviceable the textbooks have to be adopted in accordance with the ends in view. These are to be related to the material in connection with which they are to be used by the teachers and the pupils at different levels of ability and experience.

Textbooks in educational institutions have been the authority on the subject matter and essential tools for the subjects, as well as guidance in the methods and procedures to be followed by the teacher and the student. Textbook is the most commonly used instructional material because it is the cheapest and the best source of graded instruction and practical exercises, a convenient source of material for discussion and study and a helper for unskilled teacher in class management, enabling him not to bother about duplicated exercises and dictated directions.
The textbooks is the core of all materials and activities and better organization of the contents and methods in a textbook assures better formation of concepts of basic principles and fundamental relations.

It is portable, compact, and enduring. It can be read for a few minutes at a time or for many hours at a stretch. It can be studied or skimmed quickly, read once or reread often. All students can be given the same reading assignment or each can be given different one. They can move through the material at the same pace or at very different speeds. The reader can move from the beginning of the book to the end or he can jump erratically from one section to another. He can use his book in class, at home or in the library.

Although various kinds of teaching materials and aids are now available to the teacher, especially in more advanced counties, yet the textbook still continues to be the most widely used teaching aid at all levels from primary grades to the university, for the following reasons.

a. It presents sequentially arranged content which has been organized ahead of time for the convenience and use of the teacher and pupils.

b. Accuracy of facts collected in a textbook is well established.

c. The content is organized on sound logical or psychological principles.

d. It contains explanatory and even though provoking illustration related to the subject matter under discussion.

e. It presents basic learning material in a single volume or as it were in well-defined, single physical space.
2.11.3 Why and How Teachers use text books?

Some experts like Allwright (1999) and Cunnings Worth (1984, p.65) believe that text book is only a initial position for which teachers are motivated. But Sheldon (1988) is of the view that text books are heavily used by the teachers. He has given three main reasons for massive use of text books by the teachers.

1. It is very difficult for teachers to develop their own class room material being an extremely difficult job.

2. Teaching profession is time demanding by nature and therefore teachers have rare time to develop their classroom material.

3. External pressure by different agencies.

Skierso (1991) is of the opinion that most of the teachers like to follow text book word to word just to avoid labour involved in the process of lesson planning. Whereas O’Neill (1990) believed that text books have not been designed for any specific class of students. Rather text books should benefit both the teacher and the students.

From the above discussion researcher concludes that there should be a balance in the use of text book by the teachers as a guide and they should develop professional competency to inculcate desired skills among the students.
2.12 MATHEMATICS EDUCATION

2.12.1 Mathematics and its Nature

Mathematics today has become a diverse discipline much more than arithmetic and geometry. On one hand it helps us in understanding the world around us and on other hand it assists us in dealing with the all kind of data, measurement, human behavior and observation from science.

Practically mathematics is a science of pattern with numbers, algorithm and change as its domain. As an abstract science mathematics depends on logical reasoning as a standard to discover the ultimate reality.

The special role of mathematics is the manifestation of its world wide applicability. Mathematical results like theorem and theories are both important and helpful through its theorems; mathematics offers both a foundation of truth and a standard of certainty.

Besides theorems and theories, modeling, abstraction, optimization, logical reasoning, analysis, inference from data and use of symbols are other remarkable results of mathematics. It also offers us powerful and versatile modes of thought that build mathematical power in an individual to think and read logically and critically, to point out discrepancies, to detect partiality, to judge risks and to suggest different alternatives. It also helps us in understanding this information laden world in a better way.

2.12.2 Importance of Mathematics in Historical Contemporary Societies

Mathematics plays an important role in the complex world of science and technology. The scientific and technological development since 1940 emphasized for the first time that we live in scientific age and the disciplines which support this scientific
and technologist civilization such as physics, chemistry, engineering, the management sciences, economic, the biological and medical sciences and the behavioral sciences all require Mathematics for their understanding and their further development. The place of mathematics in education must be determined by analysis of the society, the culture and the civilization, which the education is designed to serve. The dominant features of our civilization today are a series of major even revolutionary scientific developments, which have occurred in the twentieth century. Mathematics by virtue of its extensive, practical applications and the aesthetic appeal of its methods and results has long held a prominent place in education

Mathematics occupies a central position in curriculum. It is a compulsory subject from class I – X. It is being taught as an integrated subject. It covers various areas like arithmetic, algebra, geometry, trigonometry and statistics etc. Mathematics has gained the status of a special and universal language, which enables man to express his ideas about shape, quantity and relationship. Therefore knowledge of Mathematics is essential for successful life. The traditional theories of mathematics have been changed with the advent of the computer. In the past, application of mathematics was limited in extent. It is to be conceived as an integrated study of the learner’s environment, which contains the element of mathematics. The development of mathematics concept in our children will be best achieved mathematics concepts from concrete situations needs perceptive teaching.

Gall and Hicks (1964) described that mathematics has played a key role in science, technology, industry, business, and agriculture. Its study has been associated with habits of effective thinking, intellectual independence, aesthetic appreciation and creative expression. Yet we allowed these objectives and opportunities to become
stagnant until the challenges of the modern world started as out of our complacency. In the new era, mathematics is being substantially used in all walks of life. If a county wants to produce men and women who can manage the subject at these higher levels, then it must make sure that the suitable basis are provided at secondary school level (Farooq et al., 2005).

2.12.3 Delivery of Mathematics

Teacher having poor mathematics knowledge both in contents and methodology areas are not able to contribute positively to the successful delivery of the subject. Even if a teacher is capable in content area but not in delivery system then his teaching strategy would remain a mismatch. Unfortunately, any curriculum change which put mathematics teachers in trouble is usually left by them. Mostly they leave the newly introduced topics untouched. Most commonly left out topics at secondary school level which exists since long are the (i) Concept of Function and Mapping (ii) exercises of Theorems; (iii) the Practical Geometry and (iv) Concept of Matrices. Many teachers during teacher training were inquired about it. They regretted their inability to understand and therefore its delivery to the students. Similarly, teachers feel handicap while solving the problems related to the theorems and of practical geometry. Indeed there are many more factors which were observed while examining delivery of mathematics education during an appraisal study (NISTE, 1999).

2.12.4 Secondary School Mathematics Teachers

Mathematics teachers at secondary school level in Pakistan are by requirement, mathematics graduates with Bachelor degree in Education (B.Ed). Shortage of qualified mathematics teachers is a worldwide phenomenon and Pakistan is no exception
(Anderson, 1998). Secondary schools in disadvantaged areas are particularly deficient in mathematics teachers. The result is that less qualified teacher and sometimes-unqualified teachers are entrusted the work of mathematics teaching, which is detouring the whole system of education. (Bhatti, 1987)

### 2.12.5 Professional Competency of the Mathematics Teachers

The aspect of Mathematics Education is very crucial and demands immediate attention for the better development of Mathematics teachers and better delivery of the National Curriculum Policy into practice in the perspective of classroom situation. This can be done through strengthening use of some innovative techniques. Teaching strategies particularly in Mathematics education, such as exposition and discussion practical work, problem solving, investigation work, drill works and motivation need to be supported by some technology, which is on the doorstep of Pakistan now a days. This would indeed help both teachers and students to develop mathematical power and habit of how to mathematize a given situation (Harries, 1986).

### 2.12.6 Factors Affecting /Influencing Students Achievements in Mathematics

Schunk, (1990) is of the view that students who think stable factor like effort as a prior source of success have higher achievement expectation then that of student having instable factor like luck as a prior source of success have low achievement expectation.

#### a) Mathematical Attitude

Though the theoretical approaches do not support effect of research in the field yet research conducted by many indicate a correlation between attitude and achievement in
the subject of mathematics. Students having positive attitude towards mathematics also perceive mathematics being useful and of great interest (Callahan, 1971).

**b) Parents Attitude**

Parent’s attitude is an important factor in determining student’s achievement and attitude towards mathematics. In the words of Kulm (1980) desires and expectations of parents are important factors for success and failure of students in mathematics.

**c) Gender Differences**

Gender differences are another important factor influencing mathematics achievement of the students. Husen (1967) argued that participation of girls in mathematics education have remarkably reduced magnitude of gender effect.

**d) Parents level of Education**

Parents level of Education and their occupational status also influence the students achievement in the subject of mathematics (Ainley, Graetz, Long & Batten, 1995).

**2.12.7 Problems and Issues of Mathematics Curricula at National and International Level**

Some problems have been identified in the Mathematics curriculum. These are described below:

**a) Curriculum function**

There is wide gap between the school teacher and the teachers of the higher level. There is need to develop liaison, not only in terms of content but in relation to level of teacher imparting mathematics education.
b) **Text book and teachers guidelines preparation**

In the preparation of Mathematics text the teacher and school level are totally neglected. At both levels i-e national and, international, the teachers of the junior classes should be encouraged and the talent and experience of the school level should be exploited.

c) **The Lack of Audio video aids**

At national level particularly and international level generally, the AV aids are in short supply. If the AV aids are adequately and properly used, the students can get a great deal of support in learning concepts of mathematics in a much better way.

d) **Trained Teachers**

There is deficiency of qualified and trained teacher. Mathematics trained teachers are not easily available throughout the world. This is a misfortune, faced not only locally, but at the international also.

e) **Teacher training**

The training programme for teachers of mathematics is not good. In the past the trainees passed out from the training colleges were in a position to teach effectively at the school and college level. It is high time that the teacher training programmes should be nicely prepared and the standard of training improved.

f) **Shortage of library books**

The mathematics books are not available to the students and books of new course are not stocked in the libraries. The students as well as teachers face difficulty in finding good books of mathematics which is a great dilemma.
g) The examination system

The examination is also defective. The paper setting is done in a traditional way and step-wise arrangement is not given credit. The question paper is designed in such a way that it promotes rote learning and does not help the students in logical thinking (Quadling, 1986).

2.12.8 The Mathematics Curriculum in Pakistan

The curriculum of mathematics had been revised no of time since 1947. It was revised in 1968 and sets were introduced at grade 9th and 10th level. As a result of this revision major changes in subject matter and text books were carried out. Therefore this revision of curriculum was named a modernization of mathematics curriculum. (Government of Pakistan, 1968)

In 1972, 73 mathematics curriculum was again revised to make the content concept oriented. Inductive and deductive approaches were introduced. The revised draft was implemented from 1979. In 1986 it was again tried to revamp the mathematics curriculum but the effort ended with few minor changes (Govt. of Pakistan, 1986)

A major breakthrough in the history of development of mathematics curriculum for secondary school level was initiated in the year 1994, when a unified curriculum was developed for science as well as arts students. A new chapter information handling was added with the existing parts like Set, Numbers, Algebra, Geometry and Trigonometry. But the element of shortage of teachers in the schools was neglected at the time of implementation of this curriculum in 1995.(Govt. of Pakistan, 1994).
Tahir (1997) evaluating this curriculum opened that major portion of this new curriculum was a copy of the previous one that was in practice for elective groups students. Teachers teaching arts group were compelled to teach this new curriculum without any refresher course. The shortage of teacher in female schools was neglected.

In December 1999 a task force was established by Govt. of the Punjab Education Department to modernize curriculum so that the new curriculum was in accord with developed world in content and approach. The initial draft of the curriculum was developed by the task force of the Punjab Education Department (PED) and then sent for comments to other Provinces and Federal Government. After approval this curriculum was implemented from the academic year 2003.

The analysis of present mathematics curriculum for Classes IX-X when compared with curriculum of 1994 revealed that no crucial change has been introduced in this curriculum rather this is close to the curriculum of 1986 (NISTE, 2000). Nevertheless, the sequence of some of the topics in a few chapters of this curriculum is different, whereas, chapter such as “information handling” has been heavily extended. However, the most important among the salient features of this curriculum is the grass root change towards the delivery approach of mathematics.

2.12.9 Objectives of Teaching Mathematics (Classes IX-X)

1. To enable students to acquire understating of concepts of Mathematics and to apply them to the problems of the world they live in.

2. To provide the students with sound basis for specialization in Mathematics at higher stages or to apply it in scientific and technical fields.
3. To enable the students to reason consistently, to draw correct conclusions for give hypotheses; and to inculcate in them a habit of examining any situation critically and analytically.

4. To enable the students to communicate their thoughts through symbolic expressions and graphs.

5. To develop sense of distinction between relevant and irrelevant data.

6. To give the students basic understanding and awareness of the power of Mathematics in generalization and abstraction.

7. To foster in students the spirit of exploration and discovery.

8. Also curriculum wing ministry of education have given instructional objectives (expected outcomes) of teaching mathematics at secondary school level in Pakistan that have been given in (Annexure D). (Govt. of Pakistan, 2002)

2.13 REVIEW OF RELATED RESEARCHES

The following segment appraises the research studies in the realm of mathematics and science education. The focus was to recognize and take account of studies that are related to science and mathematics curriculum.

The examination in Pakistan is totally based on the topics of the textbook. These examinations just evaluate the lower order skills of the students and not the higher order skills like creativity, logical reasoning and scientific thinking. (SPDC 2003, P .129)

In a historical account Iqbal & Mahmood (2000) has revealed that number of educational policies made during the period 1972-2010 emphasized a shift away from
general education to scientific and technical education, and the curriculum should be formulated in such a way that it may drift students’ interest towards science subjects.

Kiani (2002) conducted a research titled as, a comparative study regarding Pakistani secondary and British GCE – O level programme with special reference to science education. He recommended that curriculum at this level may be based upon scientific thinking and inculcation of logical attitudes and curiosity. He has further recommended that content may be selected on the basis of modern need of time and concept of multiple textbook may be adopted.

Jan’s (2003) study points out that language of science subjects differ substantially from general subjects as reliance is placed on use of symbols, diagrams, and pictures, to represent mathematics. This, according to him, is not an easy task to learn for students by themselves.

Chaudary (1993) conducted a research on the practice of teaching physics in the secondary school of the Punjab found that in majority school; physics teaching was done by lecture method and by traditional chalk and talk method. He further recommended professionally qualified teachers perform better than unqualified teacher.

Arif et al. (1998) found that all chapters of physics were presented in the previous board’s paper and question paper mainly focuses on testing knowledge and application. Comprehension and understanding needs to be emphasized in the question paper. This can only be done if teacher and paper setters are trained in the techniques of paper setting.

Rehman (2004) concluded that teachers have not been given chance to participate in the curriculum formulation, and examination support cramming and didn’t support
higher order skills. Replacement of single author book by multi author book was also recommended by him.

Halai et al. (2002) maintains while discussing science and mathematics education in Pakistan that there is no organized data which can indicate the qualification of teachers, with respect to their area of specialization. She pointed out towards the deficiency of mathematics and science teachers in the country.

Halai (2003) found that during the last twenty years mathematics and science has attained great importance and work in the area of curriculum of these subjects would result in more opportunities for students and the community and improvement in mathematics and science was seen through improving curriculum material especially the textbooks, teachers guide. She also added that text books are poorly produced.

Warick and Reimers (1997), Halai (1998, 2001, 2004, SPDC Survey 2003 ) found that typically a mathematics class room in Pakistan is characterized by no focus on developing higher order skills among the students. According to them much focus is placed on memorization rather than concept development. This is because of the lack of flexibility in the curriculum and teaching is just restricted to achievements in examinations.

Samuel (2002) established that problem solving seem to be a useful method to teach and learn mathematics and it enriched the curriculum content through tasks which offer a higher level of cognitive test to the student. His findings were further compounded by the reality that the content of existing mathematics text book lent themselves heavily to conventional methods.
The above review supports the viewpoint of Halai (2007) that there are very few research studies in mathematics and science education. Proper attention has not been given by the researchers to this field in Pakistan. According to her viewpoint mostly the issues are common in science and mathematics curriculum reform. In the wake of this discussion it may be inferred that a comprehensive research in the field of mathematics curriculum would be highly significant.
CHAPTER 3

RESEARCH METHODOLOGY

This research was intended to analyze the National Mathematics Curriculum at Secondary School level in Pakistan. Various methods were employed by the researcher to investigate the objectives of this study. This study was descriptive in design and extensive literature review was carried out to understand the previous related studies on the topic.

3.1 POPULATION

Population for this study constituted all the curriculum experts working in different organizations in Pakistan and working teachers teaching mathematics at secondary school level in Pakistan. According to Pakistan Education Statistics (2007-08), there were 1266 urban and 3823 rural (including 1908 female and 3181 female) high and higher secondary schools in the province of Punjab. The ratio between urban and rural was 1:3 whereas between male and female it was approximately 1:2. Total number of teachers teaching in these schools was 100824 (including 61872 male and 38952 female).

3.2 SAMPLE

Random and convenient sampling measures were used for the selection of experts for interview. Distribution of the experts is as under:

1. Curriculum experts 15
2. Research Officers of BISEs 05
3. Curriculum experts from Punjab Textbook Board 05
4. One thousand and eighty Mathematics teachers from 540 schools (two teachers from each school) of Punjab province were selected through proportionate stratified random sampling.

**Distribution of Sample schools from each District**

<table>
<thead>
<tr>
<th>Gender</th>
<th>Rural</th>
<th>Urban</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>30</td>
<td>10</td>
<td>40</td>
</tr>
<tr>
<td>Female</td>
<td>15</td>
<td>05</td>
<td>20</td>
</tr>
<tr>
<td>Total</td>
<td>45</td>
<td>15</td>
<td>60</td>
</tr>
</tbody>
</table>

**Distribution of Sample teachers**

<table>
<thead>
<tr>
<th>Region</th>
<th>District</th>
<th>Rural</th>
<th>Urban</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Male</td>
<td>Female</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Male</td>
<td>Female</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>M+F</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Northern</td>
<td>Rawalpindi</td>
<td>60</td>
<td>30</td>
<td>120</td>
</tr>
<tr>
<td></td>
<td>Chakwal</td>
<td>60</td>
<td>30</td>
<td>120</td>
</tr>
<tr>
<td></td>
<td>Jhelum</td>
<td>60</td>
<td>30</td>
<td>120</td>
</tr>
<tr>
<td>Central</td>
<td>Lahore</td>
<td>60</td>
<td>30</td>
<td>120</td>
</tr>
<tr>
<td></td>
<td>Gujranwala</td>
<td>60</td>
<td>30</td>
<td>120</td>
</tr>
<tr>
<td></td>
<td>Hafizabad</td>
<td>60</td>
<td>30</td>
<td>120</td>
</tr>
<tr>
<td>Southern</td>
<td>Multan</td>
<td>60</td>
<td>30</td>
<td>120</td>
</tr>
<tr>
<td></td>
<td>Khanewal</td>
<td>60</td>
<td>30</td>
<td>120</td>
</tr>
<tr>
<td></td>
<td>Muzaffar Garh</td>
<td>60</td>
<td>30</td>
<td>120</td>
</tr>
<tr>
<td>Total</td>
<td>540</td>
<td>270</td>
<td>180</td>
<td>90</td>
</tr>
</tbody>
</table>
3.3 RESEARCH INSTRUMENTS

To collect data, following research instruments were developed and administered:

3.3.1 Questionnaire for Teachers

Questionnaire for teachers was prepared on three point rating scale (Annex-A). It consisted of items with personal data in part I whereas part II was pertaining to the achievement of policy objectives given by the Curriculum Wing, Ministry of Education, Islamabad. Part III of this questionnaire was related to the subject matter, content and textbook, part IV related to teaching methodology and Part V was related to the evaluation process. In part VI focus was on achievement of instructional objectives (expected outcomes for class IX) given by curriculum wing, ministry of education, and in part VII five open ended questions were asked. In part VIII respondents were asked for the gradation of units of 9th class.

3.3.2 Interview schedule for experts of Mathematics/Science Education

The interviews were conducted personally by the researcher according to the availability of the experts/educationists (Annex-B).

3.4 VALIDITY AND RELIABILITY OF INSTRUMENTS

Before the administration of the questionnaire, to make it valid and reliable, it was reviewed by the experts and then pilot tested. Ten educationists/experts from the department of education in the universities and curriculum wing were included in this study to review the questionnaire. Then fifty mathematics teachers teaching at secondary school level from districts Attock and Sheikhupura were selected randomly for this purpose. The questionnaire was amended and improved in the light of opinions of these
teachers and experts. Some items regarding objectives of teaching mathematics, content, and textbook were amended and some items relating to teaching methodology were found irrelevant and therefore deleted. In addition, some open ended items were also restated. For reliability, Cronbach’s alpha was used. The calculated value for the said questionnaire was found to be 0.842 which confirmed its reliability.

3.5 DATA COLLECTION

Data was collected through the administration of researcher made questionnaire for the teachers and interview schedule for curriculum experts/educationists separately. The questionnaire was administered personally as well as through contacts and mail. An interview with the curriculum experts was conducted personally by the researcher.

3.6 DATA ANALYSIS

Collected data were analyzed by using percentage, and chi square test. Each statement was framed on three point Likert scale which has three options namely; Agreed (A), Undecided (UD), and Disagree (DA)

3.7 DELIMITATIONS

Keeping in view the limited time and resources, the study was delimited to the following:

1. Mathematics curriculum of 9th Class

2. Punjab Province

1. Public School Teachers teaching the subject of Mathematics at secondary school level
CHAPTER 4

RESULTS AND DISCUSSION

The major objectives of the study were to analyze the national mathematics curriculum at secondary school level in Pakistan. This section deals with the interpretation and analysis of the data. The data was collected through questionnaire for secondary school mathematics teachers and interviews from curriculum experts. Percentages and chi square methods were used to analyze the data.

4.1 RESPONSES OF TEACHERS

Table 1: Academic qualification of teachers

<table>
<thead>
<tr>
<th>S. No</th>
<th>Qualification</th>
<th>No of teachers</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>F. Sc.</td>
<td>53</td>
<td>6.13</td>
</tr>
<tr>
<td>2</td>
<td>B.Sc.</td>
<td>462</td>
<td>53.47</td>
</tr>
<tr>
<td>3</td>
<td>B.S.Ed.</td>
<td>114</td>
<td>13.19</td>
</tr>
<tr>
<td>4</td>
<td>M.Sc.</td>
<td>235</td>
<td>27.20</td>
</tr>
</tbody>
</table>

Total number of responses = 864
The above data points out that majority (53.47%) of sample teachers had B. Sc qualification; 27.20% had M.Sc as academic qualification, 13.19% teachers possessed B.S. Ed, and only 6.13% had F. Sc as academic qualification.
Table 2: Professional qualification of teachers

<table>
<thead>
<tr>
<th>S.No</th>
<th>Qualification</th>
<th>No of teachers</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>B.Ed.</td>
<td>274</td>
<td>31.71</td>
</tr>
<tr>
<td>2</td>
<td>B.S.Ed.</td>
<td>73</td>
<td>8.45</td>
</tr>
<tr>
<td>3</td>
<td>M.Ed.</td>
<td>455</td>
<td>52.66</td>
</tr>
<tr>
<td>4</td>
<td>M.A. (Edu.)</td>
<td>62</td>
<td>7.18</td>
</tr>
</tbody>
</table>

Total number of responses = 864

The above data points out that majority (52.66%) of sample secondary school mathematics teachers had M.Ed qualification 31.71% had B.Ed as professional qualification; 8.45% teachers possessed B.S.Ed, and only 7.18% had M.A (Education) as professional qualification.
Table 3: Teaching experience of teachers

<table>
<thead>
<tr>
<th>S.No</th>
<th>Years</th>
<th>No of teachers</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0-5</td>
<td>105</td>
<td>12.15</td>
</tr>
<tr>
<td>2</td>
<td>5-10</td>
<td>283</td>
<td>32.75</td>
</tr>
<tr>
<td>3</td>
<td>10-15</td>
<td>186</td>
<td>21.53</td>
</tr>
<tr>
<td>4</td>
<td>15-20</td>
<td>176</td>
<td>20.37</td>
</tr>
<tr>
<td>5</td>
<td>Above 20</td>
<td>114</td>
<td>13.19</td>
</tr>
</tbody>
</table>

Total number of responses=864

The above table reveals that majority (55.00%) of the sample teachers had more than 10 years of teaching experience, 32.75% had 5-10 years of experience, and only 12.15% had 5 years or less experience. It means that the data obtained from sample is reliable due to this factor.
Table 4: Present curriculum of mathematics enables students to acquire understanding of mathematics concepts

<table>
<thead>
<tr>
<th>Options</th>
<th>A</th>
<th>UD</th>
<th>DA</th>
<th>Total</th>
<th>$\chi^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Responses</td>
<td>576</td>
<td>77</td>
<td>211</td>
<td>864</td>
<td>463.17*</td>
</tr>
<tr>
<td>Percentage</td>
<td>66.67%</td>
<td>8.91%</td>
<td>24.42%</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

df=2  

Table value of $\chi^2$ at 0.05 level of significance=5.99

Above table shows that;

$\chi^2$ value > the table value at 0.05 level of significance.

This shows that the respondents differ in their opinion significantly. Moreover, the majority of the respondents have accepted the statement. Therefore the statement, “The present curriculum of mathematics enables the students to acquire understanding of mathematics concepts” is accepted.
Table 5: Present Curriculum enables students to apply concepts to world problems

<table>
<thead>
<tr>
<th>Options</th>
<th>A</th>
<th>UD</th>
<th>DA</th>
<th>Total</th>
<th>( \chi^2 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Responses</td>
<td>202</td>
<td>101</td>
<td>561</td>
<td>864</td>
<td>405.88</td>
</tr>
<tr>
<td>Percentage</td>
<td>23.38%</td>
<td>11.69%</td>
<td>64.93%</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

df=2

Above table shows that;

\( \chi^2 \) value > the table value at 0.05 level of significance.

This shows that the respondents differ in their opinion significantly. Moreover, the majority of the respondents have accepted the statement. Therefore the statement, “Present curriculum of mathematics enables the students to acquire understanding of mathematics concepts” is rejected.
Table 6: Present curriculum of mathematics provides sound basis for higher studies

<table>
<thead>
<tr>
<th>Options</th>
<th>A</th>
<th>UD</th>
<th>DA</th>
<th>Total</th>
<th>$\chi^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Responses</td>
<td>501</td>
<td>90</td>
<td>273</td>
<td>864</td>
<td>294.44</td>
</tr>
<tr>
<td>Percentage</td>
<td>57.99%</td>
<td>10.42%</td>
<td>31.60%</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

df=2 Table value of $\chi^2$ at 0.05 level of significance=5.99

Table 6 shows that $\chi^2$ value (294.44) is found larger than that of the table value at 5% significant level. It points out that respondents differ in their opinion significantly. Moreover, the majority of the responding teachers (57.99%) has accepted the statement therefore the statement, “Present curriculum provides sound basis for higher studies” is accepted.
Table 7: Present curriculum of mathematics enable students to reason consistently

<table>
<thead>
<tr>
<th>Options</th>
<th>A</th>
<th>UD</th>
<th>DA</th>
<th>Total</th>
<th>$\chi^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Responses</td>
<td>331</td>
<td>91</td>
<td>442</td>
<td>864</td>
<td>223.52</td>
</tr>
<tr>
<td>Percentage</td>
<td>38.31%</td>
<td>10.53%</td>
<td>51.16%</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

df=2  Table value of $\chi^2$ at 0.05 level of significance=5.99

It points out that respondents differ in their opinion significantly.

Table 7 shows that $\chi^2$ value (223.52) is found larger than that of the table value at 5% significant level. It points out that respondents differ in their opinion significantly. Moreover, the majority of the responding teachers did not accept the statement therefore the statement “Present curriculum of mathematics enable students to reason consistently” is rejected.
Table 8: Students can draw correct conclusion for given hypothesis

<table>
<thead>
<tr>
<th>Options</th>
<th>A</th>
<th>UD</th>
<th>DA</th>
<th>Total</th>
<th>$\chi^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Responses</td>
<td>193</td>
<td>130</td>
<td>541</td>
<td>864</td>
<td></td>
</tr>
<tr>
<td>Percentage</td>
<td>22.34%</td>
<td>15.05%</td>
<td>62.62%</td>
<td>100%</td>
<td>340.27</td>
</tr>
</tbody>
</table>

df=2

Table value of $\chi^2$ at 0.05 level of significance=5.99

The table 8 shows that $\chi^2$ value (340.27) in the above case is larger than that of the table value at 5% significant level. It points out that respondents differ in their opinion significantly. Moreover, the majority of the responding teachers has rejected the statement therefore the statement “Students can draw correct conclusion for given hypothesis” is rejected.
Table 9: Present curriculum inculcates habit of examining any situation critically and analytically

<table>
<thead>
<tr>
<th>Options</th>
<th>A</th>
<th>UD</th>
<th>DA</th>
<th>Total</th>
<th>$\chi^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Responses</td>
<td>192</td>
<td>84</td>
<td>588</td>
<td>864</td>
<td></td>
</tr>
<tr>
<td>Percentage</td>
<td>22.22%</td>
<td>9.72%</td>
<td>68.06%</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

$\text{df}=2$ Table value of $\chi^2$ at 0.05 level of significance=5.99

The table 9 shows that $\chi^2$ value (489.00) in the above case is larger than that of the table value at 5% significant level. It points out that respondents differ in their opinion significantly. Moreover, the majority of the responding teachers has rejected the statement therefore the statement “Present curriculum inculcates habit of examining any situation critically and analytically” is rejected
Table 10: Present curriculum enables the students to communicate their thoughts through symbolical expression and graphs

<table>
<thead>
<tr>
<th>Options</th>
<th>A</th>
<th>UD</th>
<th>DA</th>
<th>Total</th>
<th>$\chi^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Responses</td>
<td>465</td>
<td>143</td>
<td>256</td>
<td>864</td>
<td>185.34</td>
</tr>
<tr>
<td>Percentage</td>
<td>53.82%</td>
<td>16.55%</td>
<td>29.63%</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

df=2

Table value of $\chi^2$ at 0.05 level of significance=5.99

Table 10 shows that $\chi^2$ value (185.34) in the above case is larger than that of the table value at 5% significant level. It points out that respondents differ in their opinion significantly. Moreover, the majority of the responding teachers has accepted the statement therefore the statement, “Present curriculum enables the students to communicate their thoughts through symbolical expression and graphs” is accepted.
Table 11: Develops a sense of distinction between relevant and irrelevant data

<table>
<thead>
<tr>
<th>Options</th>
<th>A</th>
<th>UD</th>
<th>DA</th>
<th>Total</th>
<th>χ²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Responses</td>
<td>452</td>
<td>81</td>
<td>331</td>
<td>864</td>
<td></td>
</tr>
<tr>
<td>Percentage</td>
<td>52.31%</td>
<td>9.38%</td>
<td>38.31%</td>
<td>100%</td>
<td>248.59</td>
</tr>
</tbody>
</table>

Table value of χ² at 0.05 level of significance=5.99

df=2

Table 11 shows that χ² value (248.59) in the above case is larger than that of the table value at 5% significant level. It points out that respondents differ in their opinion significantly. Moreover, the majority of the responding teachers has accepted the statement therefore the statement, “develops a sense of distinction between relevant and irrelevant data” is accepted
Table 12: Gives the student basic understanding and awareness of power of Mathematics

<table>
<thead>
<tr>
<th>Options</th>
<th>A</th>
<th>UD</th>
<th>DA</th>
<th>Total</th>
<th>$\chi^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Responses</td>
<td>471</td>
<td>105</td>
<td>288</td>
<td>864</td>
<td>232.56</td>
</tr>
<tr>
<td>Percentage</td>
<td>54.51%</td>
<td>12.15%</td>
<td>33.33%</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

df=2

Table value of $\chi^2$ at 0.05 level of significance=5.99

Table 12 shows that $\chi^2$ value (232.56) in the above case is larger than that of the table value at 5% significant level. It points out that respondents differ in their opinion significantly. Moreover, the majority of the responding teachers has accepted the statement therefore the statement, “Gives the student basic understanding and awareness of power of mathematics” is accepted
Table 13: Fosters in students the spirit of exploration and discovery

<table>
<thead>
<tr>
<th>Options</th>
<th>A</th>
<th>UD</th>
<th>DA</th>
<th>Total</th>
<th>$\chi^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Responses</td>
<td>301</td>
<td>99</td>
<td>464</td>
<td>864</td>
<td>232.17</td>
</tr>
<tr>
<td>Percentage</td>
<td>34.84%</td>
<td>11.46%</td>
<td>53.70%</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

df=2 Table value of $\chi^2$ at 0.05 level of significance=5.99

Table 13 shows that $\chi^2$ value (232.17) in the above case is larger than that of the table value at 5% significant level. It points out that respondents differ in their opinion significantly. Moreover, the majority of the responding teachers has rejected the statement therefore the statement “Fosters in students the spirit of exploration and discovery” is rejected.
Table 14: Contents are according to mental level of students

<table>
<thead>
<tr>
<th>Options</th>
<th>A</th>
<th>UD</th>
<th>DA</th>
<th>Total</th>
<th>( \chi^2 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Responses</td>
<td>517</td>
<td>92</td>
<td>255</td>
<td>864</td>
<td>319.26</td>
</tr>
<tr>
<td>Percentage</td>
<td>59.84%</td>
<td>10.65%</td>
<td>29.51%</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

\( df=2 \) Table value of \( \chi^2 \) at 0.05 level of significance=5.99

Table 14 shows that \( \chi^2 \) value (319.26) in the above case is larger than that of the table value at 5% significant level. It points out that respondents differ in their opinion significantly. Moreover, the majority of the responding teachers has accepted the statement therefore the statement, “Contents are according to mental level of student” is accepted.
Table 15: The subject matter of the book creates interest among the students

<table>
<thead>
<tr>
<th>Options</th>
<th>A</th>
<th>UD</th>
<th>DA</th>
<th>Total</th>
<th>$\chi^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Responses</td>
<td>453</td>
<td>105</td>
<td>306</td>
<td>864</td>
<td>211.94</td>
</tr>
<tr>
<td>Percentage</td>
<td>52.43%</td>
<td>12.15%</td>
<td>35.42%</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

df=2

Table value of $\chi^2$ at 0.05 level of significance=5.99

Table 15 shows that $\chi^2$ value (211.94) in the above case is larger than that of the table value at 5% significant level. It points out that respondents differ in their opinion significantly. Moreover, the majority of the responding teachers has accepted the statement therefore the statement,” The subject matter of the book creates interest among the students” is accepted.
Table 16: The subject matter produces creativity among the students

<table>
<thead>
<tr>
<th>Options</th>
<th>A</th>
<th>UD</th>
<th>DA</th>
<th>Total</th>
<th>$\chi^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Responses</td>
<td>240</td>
<td>91</td>
<td>533</td>
<td>864</td>
<td>351.17</td>
</tr>
<tr>
<td>Percentage</td>
<td>27.78%</td>
<td>10.53%</td>
<td>61.69%</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

df=2 Table value of $\chi^2$ at 0.05 level of significance=5.99

Table 16 shows that $\chi^2$ value (351.17) in the above case is larger than that of the table value at 5% significant level. It points out that respondents differ in their opinion significantly. Moreover, the majority of the responding teachers has rejected the statement therefore the statement “The subject matter produces creativity among the students” is rejected.
Table 17: The subject matter develops problem solving skills among the students

<table>
<thead>
<tr>
<th>Options</th>
<th>A</th>
<th>UD</th>
<th>DA</th>
<th>Total</th>
<th>( \chi^2 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Responses</td>
<td>189</td>
<td>83</td>
<td>592</td>
<td>864</td>
<td>500.84</td>
</tr>
<tr>
<td>Percentage</td>
<td>21.88%</td>
<td>9.61%</td>
<td>68.52%</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

df=2  
Table value of \( \chi^2 \) at 0.05 level of significance=5.99

Table 17 shows that \( \chi^2 \) value (500.84) in the above case is larger than that of the table value at 5% significant level. It points out that respondents differ in their opinion significantly. Moreover, the majority of the responding teachers has rejected the statement therefore the statement “The subject matter develops problem solving skills among the students” is not accepted
Table 18: The subject matter develops habit of logical reasoning among the students

<table>
<thead>
<tr>
<th>Options</th>
<th>A</th>
<th>UD</th>
<th>DA</th>
<th>Total</th>
<th>$\chi^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Responses</td>
<td>262</td>
<td>103</td>
<td>499</td>
<td>864</td>
<td>275.77</td>
</tr>
<tr>
<td>Percentage</td>
<td>30.32%</td>
<td>11.92%</td>
<td>57.75%</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

Table value of $\chi^2$ at 0.05 level of significance=5.99

Table 18 shows that $\chi^2$ value (275.77) in the above case is larger than that of the table value at 5% significant level. It points out that respondents differ in their opinion significantly. Moreover, the majority of the responding teachers has rejected the statement therefore the statement “The subject matter develops habit of logical reasoning among the students” is rejected.
Table 19: The introduction of each chapter clearly highlights the contents of corresponding units

<table>
<thead>
<tr>
<th>Options</th>
<th>A</th>
<th>UD</th>
<th>DA</th>
<th>Total</th>
<th>( \chi^2 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Responses</td>
<td>531</td>
<td>119</td>
<td>214</td>
<td>864</td>
<td>323.22</td>
</tr>
<tr>
<td>Percentage</td>
<td>61.46%</td>
<td>13.77%</td>
<td>24.77%</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

df=2 Table value of \( \chi^2 \) at 0.05 level of significance=5.99

Table 19 shows that \( \chi^2 \) value (323.22) in the above case is larger than that of the table value at 5% significant level. It points out that respondents differ in their opinion significantly. Moreover, the majority of the responding teachers has accepted the statement therefore the statement, “The introduction of each chapter clearly highlights the contents of corresponding units” is accepted.
Table 20: Contents given in the book help in building foundation for future science and technological education

<table>
<thead>
<tr>
<th>Options</th>
<th>A</th>
<th>UD</th>
<th>DA</th>
<th>Total</th>
<th>( \chi^2 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Responses</td>
<td>290</td>
<td>121</td>
<td>453</td>
<td>864</td>
<td>191.38</td>
</tr>
<tr>
<td>Percentage</td>
<td>33.56%</td>
<td>14.00%</td>
<td>52.43%</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

df=2  
Table value of \( \chi^2 \) at 0.05 level of significance=5.99

Table 20 shows that \( \chi^2 \) value (191.38) in the above case is larger than that of the table value at 5% significant level. It points out that respondents differ in their opinion significantly. Moreover, the majority of the responding teachers has not accepted the statement therefore the statement, “Contents given in the book help in building foundation for future science and technological education” is rejected.
Table 21: Selection of content is based upon:

<table>
<thead>
<tr>
<th>Options</th>
<th>A</th>
<th>UD</th>
<th>DA</th>
<th>Total</th>
<th>( \chi^2 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Philosophy of life</td>
<td>507</td>
<td>83</td>
<td>274</td>
<td>864</td>
<td>313.13</td>
</tr>
<tr>
<td>Percentage</td>
<td>58.68%</td>
<td>9.61%</td>
<td>31.71%</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>• Scientific thinking</td>
<td>443</td>
<td>132</td>
<td>289</td>
<td>864</td>
<td>167.92</td>
</tr>
<tr>
<td>Percentage</td>
<td>51.27%</td>
<td>15.28%</td>
<td>33.45%</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>• The acquisition of information from theories and principles</td>
<td>468</td>
<td>117</td>
<td>279</td>
<td>864</td>
<td>214.31</td>
</tr>
<tr>
<td>Percentage</td>
<td>54.17%</td>
<td>13.54%</td>
<td>32.29%</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>• Development of scientific attitude, and interest</td>
<td>411</td>
<td>146</td>
<td>307</td>
<td>864</td>
<td>123.8</td>
</tr>
<tr>
<td>Percentage</td>
<td>47.57%</td>
<td>16.90%</td>
<td>35.53%</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>Development of logical reasoning</td>
<td>281</td>
<td>117</td>
<td>466</td>
<td>864</td>
<td>211.72</td>
</tr>
<tr>
<td>Percentage</td>
<td>32.52%</td>
<td>13.54%</td>
<td>53.94%</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>• Update knowledge</td>
<td>465</td>
<td>104</td>
<td>295</td>
<td>864</td>
<td>226.51</td>
</tr>
<tr>
<td>Percentage</td>
<td>53.82%</td>
<td>12.03%</td>
<td>34.14%</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

df=2  
Table value of \( \chi^2 \) at 0.05 level of significance=5.99
Philosophy of life

Table 21 shows that $\chi^2$ value (313.13) in the above case is larger than that of the table value at 5% significant level. It points out that respondents differ in their opinion significantly. Moreover, the majority of the responding teachers has accepted the statement therefore the statement, “Criteria for the selection of content is based upon Philosophy of life” is accepted.

Scientific thinking

Table 21 shows that $\chi^2$ value (167.92) in the above case is larger than that of the table value at 5% significant level. It points out that respondents differ in their opinion significantly. Moreover, the majority of the responding teachers has accepted the statement therefore the statement, “Criteria for the selection of content is based upon scientific thinking” is accepted.

The acquisition of information from theories and principles

Table 21 shows that $\chi^2$ value (214.31) in the above case is larger than that of the table value at 5% significant level. It points out that respondents differ in their opinion significantly. Moreover, the majority of the responding teachers has accepted the statement therefore the statement, “Criteria for the selection of content is based upon the acquisition of information theories and principle” is accepted.

Development of scientific attitude and interest

Table 21 shows that $\chi^2$ value (123.8) in the above case is larger than that of the table value at 5% significant level. It points out that respondents differ in their opinion significantly. Moreover, the majority of the responding teachers has accepted the statement therefore the statement, “selection of content is based upon development of scientific attitude and interest” is accepted.
Development of logical reasoning

Table 21 shows that $\chi^2$ value (211.72) in the above case is larger than that of the table value at 5% significant level. It points out that respondents differ in their opinion significantly. Moreover, the majority of the responding teachers has not accepted the statement therefore the statement, “selection of content is based upon development of logical reasoning” is rejected.

Update knowledge

Table 21 shows that $\chi^2$ value (211.72) in the above case is larger than that of the table value at 5% significant level. It points out that respondents differ in their opinion significantly. Moreover, the majority of the responding teachers has accepted the statement therefore the statement, “Criteria for the selection of content is based upon Update knowledge” is accepted.
Table 22: Organization of content is based upon

<table>
<thead>
<tr>
<th>Options</th>
<th>A</th>
<th>UD</th>
<th>DA</th>
<th>Total</th>
<th>$\chi^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Topic wise sequence</td>
<td>491</td>
<td>127</td>
<td>246</td>
<td>864</td>
<td>239.22</td>
</tr>
<tr>
<td>Percentage</td>
<td>56.83%</td>
<td>14.7%</td>
<td>28.47%</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>Simple to complex</td>
<td>572</td>
<td>67</td>
<td>225</td>
<td>864</td>
<td>463.42</td>
</tr>
<tr>
<td>Percentage</td>
<td>66.2%</td>
<td>7.75%</td>
<td>26.04%</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>Continuity between topics</td>
<td>528</td>
<td>96</td>
<td>240</td>
<td>864</td>
<td>336.00</td>
</tr>
<tr>
<td>Percentage</td>
<td>61.11%</td>
<td>11.11%</td>
<td>27.78%</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>Integration between levels</td>
<td>246</td>
<td>129</td>
<td>489</td>
<td>864</td>
<td>234.19</td>
</tr>
<tr>
<td>Percentage</td>
<td>28.47%</td>
<td>14.93%</td>
<td>56.60%</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

$df=2$  

Table value of $\chi^2$ at 5% significant level=5.99
**Topic wise sequence**

Table 22 shows that $\chi^2$ value (239.22) in the above case is larger than that of the table value at 5% significant level. It points out that respondents differ in their opinion significantly. Moreover, the majority of the responding teachers has accepted the statement therefore the statement, “organization of content is based upon topic wise sequence” is accepted.

**Simple to complex**

Table 22 shows that $\chi^2$ value (463.42) in the above case is larger than that of the table value at 5% significant level. It points out that respondents differ in their opinion significantly. Moreover, the majority of the responding teachers has accepted the statement therefore the statement, “Simple to complex” is accepted.

**Continuity between topics**

Table 22 shows that $\chi^2$ value (336) in the above case is larger than that of the table value at 5% significant level. It points out that respondents differ in their opinion significantly. Moreover, the majority of the responding teachers has accepted the statement therefore the statement, “Continuity between topics” is accepted.

**Integration between levels**

Table 22 shows that $\chi^2$ value (234.19) in the above case is larger than that of the table value at 5% significant level. It points out that respondents differ in their opinion significantly. Moreover, the majority of the responding teachers has not accepted the statement therefore the statement, “Integration between levels” is rejected.
Table 23: Criteria for selection of activities is based upon:

<table>
<thead>
<tr>
<th>Options</th>
<th>A</th>
<th>UD</th>
<th>DA</th>
<th>Total</th>
<th>$\chi^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Curriculum objectives</td>
<td>467</td>
<td>73</td>
<td>324</td>
<td>864</td>
<td>276.26</td>
</tr>
<tr>
<td>Percentage</td>
<td>54.05%</td>
<td>8.44%</td>
<td>37.5%</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>• Understanding of concepts</td>
<td>502</td>
<td>64</td>
<td>298</td>
<td>864</td>
<td>333.58</td>
</tr>
<tr>
<td>Percentage</td>
<td>58.10%</td>
<td>7.41%</td>
<td>34.49%</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>• Verification of facts</td>
<td>431</td>
<td>118</td>
<td>315</td>
<td>864</td>
<td>173.88</td>
</tr>
<tr>
<td>Percentage</td>
<td>49.88%</td>
<td>13.66%</td>
<td>36.46%</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>• Relevance with theory</td>
<td>495</td>
<td>122</td>
<td>247</td>
<td>864</td>
<td>250.30</td>
</tr>
<tr>
<td>Percentage</td>
<td>57.29%</td>
<td>14.12%</td>
<td>28.59%</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>• Strengthening of scientific and problem solving skills</td>
<td>245</td>
<td>116</td>
<td>503</td>
<td>864</td>
<td>269.65</td>
</tr>
<tr>
<td>Percentage</td>
<td>28.36%</td>
<td>13.43%</td>
<td>58.22%</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

$\text{df}=2$  \hspace{1cm} Table value of $\chi^2$ at 0.05 level of significance=5.99
**Curriculum objectives**

Table 23 shows that $\chi^2$ value (276.26) in the above case is larger than that of the table value at 5% significant level. It points out that respondents differ in their opinion significantly. Moreover, the majority of the responding teachers has accepted the statement therefore the statement, “Criteria for selection of activities is based upon Curriculum objectives” is accepted.

**Understanding of concepts**

Table 23 shows that $\chi^2$ value (333.58) in the above case is larger than that of the table value at 5% significant level. It points out that respondents differ in their opinion significantly. Moreover, the majority of the responding teachers has accepted the statement therefore the statement, “Understanding of concepts” is accepted.

**Verification of facts**

Table 23 shows that $\chi^2$ value (173.88) in the above case is larger than that of the table value at 5% significant level. It points out that respondents differ in their opinion significantly. Moreover, the majority of the responding teachers has accepted the statement therefore the statement, “Verification of facts” is accepted.

**Relevance with theory**

Table 23 shows that $\chi^2$ value (250.30) in the above case is larger than that of the table value at 5% significant level. It points out that respondents differ in their opinion significantly. Moreover, the majority of the responding teachers has accepted the statement therefore the statement, “Relevance with theory” is accepted.
Strengthening of scientific and problem solving skills

Table 23 shows that \( \chi^2 \) value (269.65) in the above case is larger than that of the table value at 5% significant level. It points out that respondents differ in their opinion significantly. Moreover, the majority of the responding teachers has not accepted the statement therefore the statement, “Strengthening of scientific and problem solving skills” is rejected.
Table 24: Sufficiency of pictures, figures and graphs

<table>
<thead>
<tr>
<th>Options</th>
<th>A</th>
<th>UD</th>
<th>DA</th>
<th>Total</th>
<th>( \chi^2 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Responses</td>
<td>495</td>
<td>101</td>
<td>268</td>
<td>864</td>
<td>271.59</td>
</tr>
<tr>
<td>Percentage</td>
<td>57.29%</td>
<td>11.69%</td>
<td>31.02%</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

df=2  Table value of \( \chi^2 \) at 0.05 level of significance=5.99

Table 24 shows that \( \chi^2 \) value (271.59) in the above case is larger than that of the table value at 5% significant level. It points out that respondents differ in their opinion significantly. Moreover, the majority of the responding teachers has accepted the statement therefore the statement, “Sufficiency of pictures, figures, and graphs” is accepted.
Table 25: Language of text book is understandable

<table>
<thead>
<tr>
<th>Options</th>
<th>A</th>
<th>UD</th>
<th>DA</th>
<th>Total</th>
<th>( \chi^2 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Responses</td>
<td>512</td>
<td>91</td>
<td>261</td>
<td>864</td>
<td>311.51</td>
</tr>
<tr>
<td>Percentage</td>
<td>59.26%</td>
<td>10.53%</td>
<td>30.21%</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

df=2  
Table value of \( \chi^2 \) at 0.05 level of significance=5.99

Table 25 shows that \( \chi^2 \) value (311.51) in the above case is larger than that of the table value at 5% significant level. It points out that respondents differ in their opinion significantly. Moreover, the majority of the responding teachers has accepted the statement therefore the statement, “Language of text book is understandable” is accepted.
Table 26: Script of book is free of errors

<table>
<thead>
<tr>
<th>Options</th>
<th>A</th>
<th>UD</th>
<th>DA</th>
<th>Total</th>
<th>$\chi^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Responses</td>
<td>552</td>
<td>74</td>
<td>237</td>
<td>864</td>
<td>409.59</td>
</tr>
<tr>
<td>Percentage</td>
<td>63.89%</td>
<td>8.56%</td>
<td>27.55%</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

$\text{df}=2$  \hspace{1cm} Table value of $\chi^2$ at 0.05 level of significance = 5.99

Table 26 shows that $\chi^2$ value (409.59) in the above case is larger than that of the table value at 5% significant level. It points out that respondents differ in their opinion significantly. Moreover, the majority of the responding teachers has accepted the statement therefore the statement,” Script of book is free of errors” is accepted.
Table 27: Mathematics concepts in the book are understandable

<table>
<thead>
<tr>
<th>Options</th>
<th>A</th>
<th>UD</th>
<th>DA</th>
<th>Total</th>
<th>( \chi^2 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Responses</td>
<td>497</td>
<td>69</td>
<td>298</td>
<td>864</td>
<td>318.55</td>
</tr>
<tr>
<td>Percentage</td>
<td>57.52%</td>
<td>7.99%</td>
<td>34.49%</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

df=2 Table value of \( \chi^2 \) at 0.05 level of significance=5.99

Table 27 shows that \( \chi^2 \) value (318.55) in the above case is larger than that of the table value at 5% significant level. It points out that respondents differ in their opinion significantly. Moreover, the majority of the responding teachers has accepted the statement therefore the statement, “Mathematics concepts in the book are understandable” is accepted.
Table 28: Difficult concepts are clearly explained in the book

<table>
<thead>
<tr>
<th>Options</th>
<th>A</th>
<th>UD</th>
<th>DA</th>
<th>Total</th>
<th>$\chi^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Responses</td>
<td>481</td>
<td>97</td>
<td>286</td>
<td>864</td>
<td>256.02</td>
</tr>
<tr>
<td>Percentage</td>
<td>55.67%</td>
<td>11.23%</td>
<td>33.10%</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

df=2 Table value of $\chi^2$ at 0.05 level of significance=5.99

Table 28 shows that $\chi^2$ value (256.02) in the above case is larger than that of the table value at 5% significant level. It points out that respondents differ in their opinion significantly. Moreover, the majority of the responding teachers has accepted the statement therefore the statement, “Difficult concepts are clearly explained in the book” is accepted.
Table 29: Number of solved examples is sufficient

<table>
<thead>
<tr>
<th>Options</th>
<th>A</th>
<th>UD</th>
<th>DA</th>
<th>Total</th>
<th>$\chi^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Responses</td>
<td>297</td>
<td>166</td>
<td>401</td>
<td>864</td>
<td>96.30</td>
</tr>
<tr>
<td>Percentage</td>
<td>34.38%</td>
<td>19.21%</td>
<td>46.41%</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

df=2  Table value of $\chi^2$ at 0.05 level of significance=5.99

Table 29 shows that $\chi^2$ value (96.30) in the above case is larger than that of the table value at 5% significant level. It points out that respondents differ in their opinion significantly. Moreover, the majority of the responding teachers has not accepted the statement therefore the statement, “Number of solved examples is sufficient” is rejected.
Table 30: List of key words is provided in the end

<table>
<thead>
<tr>
<th>Options</th>
<th>A</th>
<th>UD</th>
<th>DA</th>
<th>Total</th>
<th>$\chi^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Responses</td>
<td>516</td>
<td>105</td>
<td>243</td>
<td>864</td>
<td>303.81</td>
</tr>
<tr>
<td>Percentage</td>
<td>59.72%</td>
<td>12.15%</td>
<td>28.12%</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

df=2  Table value of $\chi^2$ at 0.05 level of significance=5.99

Table 30 shows that $\chi^2$ value (303.81) in the above case is larger than that of the table value at 5% significant level. It points out that respondents differ in their opinion significantly. Moreover, the majority of the responding teachers has accepted the statement therefore the statement, “List of key words provided in the end ” is accepted.
Table 31: Index is provided in the end

<table>
<thead>
<tr>
<th>Options</th>
<th>A</th>
<th>UD</th>
<th>DA</th>
<th>Total</th>
<th>(\chi^2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Responses</td>
<td>583</td>
<td>49</td>
<td>232</td>
<td>864</td>
<td>511.40</td>
</tr>
<tr>
<td>Percentage</td>
<td>67.48%</td>
<td>5.67%</td>
<td>26.85%</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

df=2

Table value of \(\chi^2\) at 0.05 level of significance=5.99

Table 31 shows that \(\chi^2\) value (511.40) in the above case is larger than that of the table value at 5% significant level. It points out that respondents differ in their opinion significantly. Moreover, the majority of the responding teachers has accepted the statement therefore the statement, “Index is provided in the end” is accepted.
4.2 TEACHING METHODOLOGY

Table 32: Mathematics curriculum requires special teaching methodology

<table>
<thead>
<tr>
<th>Options</th>
<th>A</th>
<th>UD</th>
<th>DA</th>
<th>Total</th>
<th>$\chi^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Responses</td>
<td>463</td>
<td>70</td>
<td>331</td>
<td>864</td>
<td>277.77</td>
</tr>
<tr>
<td>Percentage</td>
<td>53.59%</td>
<td>8.10%</td>
<td>38.31%</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

df=2

Table value of $\chi^2$ at 0.05 level of significance=5.99

Table 32 shows that $\chi^2$ value (277.77) in the above case is larger than that of the table value at 5% significant level. It points out that respondents differ in their opinion significantly. Moreover, the majority of the responding teachers has accepted the statement therefore the statement, “Mathematics curriculum requires special teaching methodology” is accepted.
Table 33: Mathematics curriculum is based upon single text book

<table>
<thead>
<tr>
<th>Options</th>
<th>A</th>
<th>UD</th>
<th>DA</th>
<th>Total</th>
<th>$\chi^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Responses</td>
<td>695</td>
<td>36</td>
<td>133</td>
<td>864</td>
<td>869.09</td>
</tr>
<tr>
<td>Percentage</td>
<td>80.44%</td>
<td>4.17%</td>
<td>15.39%</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

$df=2$ Table value of $\chi^2$ at 0.05 level of significance=5.99

Table 33 shows that $\chi^2$ value (869.09) in the above case is larger than that of the table value at 5% significant level. It points out that respondents differ in their opinion significantly. Moreover, the majority of the responding teachers has accepted the statement therefore the statement, “Mathematics curriculum is based upon single text book” is accepted.
### Table 34: Most suitable teaching method for mathematics

<table>
<thead>
<tr>
<th>Options</th>
<th>A</th>
<th>UD</th>
<th>DA</th>
<th>Total</th>
<th>( \chi^2 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inductive-Deductive</td>
<td>481</td>
<td>115</td>
<td>268</td>
<td>864</td>
<td>234.65</td>
</tr>
<tr>
<td>Percentage</td>
<td>55.67%</td>
<td>13.31%</td>
<td>31.02%</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>Lecture</td>
<td>347</td>
<td>29</td>
<td>488</td>
<td>864</td>
<td>383.90</td>
</tr>
<tr>
<td>Percentage</td>
<td>40.16%</td>
<td>3.36%</td>
<td>56.48%</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>Demonstration</td>
<td>464</td>
<td>124</td>
<td>276</td>
<td>864</td>
<td>201.44</td>
</tr>
<tr>
<td>Percentage</td>
<td>53.70%</td>
<td>14.35%</td>
<td>31.94%</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>Activity</td>
<td>514</td>
<td>79</td>
<td>271</td>
<td>864</td>
<td>330.02</td>
</tr>
<tr>
<td>Percentage</td>
<td>59.49%</td>
<td>9.14%</td>
<td>31.37%</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>Problem solving</td>
<td>469</td>
<td>137</td>
<td>258</td>
<td>864</td>
<td>196.05</td>
</tr>
<tr>
<td>Percentage</td>
<td>54.28%</td>
<td>15.86%</td>
<td>29.86%</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

\( \text{df=2} \)  
Table value of \( \chi^2 \) at 0.05 level of significance=5.99
**Inductive-Deductive Method**

Table 34 shows that $\chi^2$ value (234.65) in the above case is larger than that of the table value at 5% significant level. It points out that respondents differ in their opinion significantly. Moreover, the majority of the responding teachers has accepted the statement therefore the statement, “Inductive-Deductive Method” is accepted.

**Lecture method**

Table 34 shows that $\chi^2$ value (383.90) in the above case is larger than that of the table value at 5% significant level. It points out that respondents differ in their opinion significantly. Moreover, the majority of the responding teachers did not accept the statement therefore the statement “Lecture method” is rejected.

**Demonstration method**

Table 34 shows that $\chi^2$ value (201.44) in the above case is larger than that of the table value at 5% significant level. It points out that respondents differ in their opinion significantly. Moreover, the majority of the responding teachers has accepted the statement therefore the statement, “Demonstration method” is accepted.

**Activity method**

Table 34 shows that $\chi^2$ value (330.02) in the above case is larger than that of the table value at 5% significant level. It points out that respondents differ in their opinion significantly. Moreover, the majority of the responding teachers has accepted the statement therefore the statement, “Activity method” is accepted.

**Problem solving method**

Table 34 shows that $\chi^2$ value (196.05) in the above case is larger than that of the table value at 5% significant level. It points out that respondents differ in their opinion
significantly. Moreover, the majority of the responding teachers has accepted the statement therefore the statement, “Problem solving method” is accepted.

Table 35: Teaching methodologies for mathematics curriculum are appropriate with respect to

<table>
<thead>
<tr>
<th>Options</th>
<th>A</th>
<th>UD</th>
<th>DA</th>
<th>Total</th>
<th>$\chi^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge</td>
<td>517</td>
<td>67</td>
<td>280</td>
<td>864</td>
<td>351.90</td>
</tr>
<tr>
<td>Percentage</td>
<td>59.84%</td>
<td>7.75%</td>
<td>32.41%</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>Scientific thinking</td>
<td>291</td>
<td>115</td>
<td>458</td>
<td>864</td>
<td>204.30</td>
</tr>
<tr>
<td>Percentage</td>
<td>33.68%</td>
<td>13.31%</td>
<td>53.31%</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>Problem solving skills</td>
<td>297</td>
<td>132</td>
<td>435</td>
<td>864</td>
<td>159.81</td>
</tr>
<tr>
<td>Percentage</td>
<td>34.38%</td>
<td>15.28%</td>
<td>50.35%</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>Logical reasoning</td>
<td>111</td>
<td>70</td>
<td>483</td>
<td>864</td>
<td>467.82</td>
</tr>
<tr>
<td>Percentage</td>
<td>16.72%</td>
<td>10.54%</td>
<td>72.74%</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>Needs of the learner</td>
<td>324</td>
<td>98</td>
<td>442</td>
<td>864</td>
<td>212.19</td>
</tr>
<tr>
<td>Percentage</td>
<td>37.50%</td>
<td>11.34%</td>
<td>51.16%</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>Readiness of the learner</td>
<td>456</td>
<td>125</td>
<td>283</td>
<td>864</td>
<td>190.34</td>
</tr>
<tr>
<td>Percentage</td>
<td>52.78%</td>
<td>14.47%</td>
<td>32.75%</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

$df=2$ Table value of $\chi^2$ at 0.05 level of significance = 5.99
Knowledge

Table 35 shows that $\chi^2$ value (351.90) in the above case is larger than that of the table value at 5% significant level. It points out that respondents differ in their opinion significantly. Moreover, the majority of the responding teachers has accepted the statement therefore the statement, “Teaching methodologies for mathematics curriculum are appropriate with respect to knowledge” is accepted.

Scientific thinking

Table 35 shows that $\chi^2$ value (204.30) in the above case is larger than that of the table value at 5% significant level. It points out that respondents differ in their opinion significantly. Moreover, the majority of the responding teachers has not accepted the statement therefore the statement, “Teaching methodologies for mathematics curriculum are appropriate with respect to scientific thinking” is rejected.

Problem solving skills

Table 35 shows that $\chi^2$ value (159.81) in the above case is larger than that of the table value at 5% significant level. It points out that respondents differ in their opinion significantly. Moreover, the majority of the responding teachers did not accept the statement therefore the statement “Teaching methodologies for mathematics curriculum are appropriate with respect to problem solving skills” is rejected.

Logical reasoning

Table 35 shows that $\chi^2$ value (467.82) in the above case is larger than that of the table value at 5% significant level. It points out that respondents differ in their opinion significantly. Moreover, the majority of the responding teachers did not accept the statement therefore the statement “Teaching methodologies for mathematics curriculum are appropriate with respect to Logical reasoning” is rejected.
Needs of the learner

Table 35 shows that $\chi^2$ value (212.19) in the above case is larger than that of the table value at 5% significant level. It points out that respondents differ in their opinion significantly. Moreover, the majority of the responding teachers has not accepted the statement therefore the statement, “Teaching methodologies for mathematics curriculum are appropriate with respect to needs of the learner” is rejected.

Readiness of the learner

Table 35 shows that $\chi^2$ value (190.34) in the above case is larger than that of the table value at 5% significant level. It points out that respondents differ in their opinion significantly. Moreover, the majority of the responding teachers has accepted the statement therefore the statement, “Teaching methodologies for mathematics curriculum are appropriate with respect to readiness of the learner” is accepted.
Table 36: Demonstration models are presented to the students to explain difficult concepts

<table>
<thead>
<tr>
<th>Options</th>
<th>A</th>
<th>UD</th>
<th>DA</th>
<th>Total</th>
<th>(\chi^2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Responses</td>
<td>220</td>
<td>66</td>
<td>578</td>
<td>864</td>
<td>479.19</td>
</tr>
<tr>
<td>Percentage</td>
<td>25.46%</td>
<td>7.64%</td>
<td>66.90%</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

df=2

Table value of \(\chi^2\) at 0.05 level of significance=5.99

Table 36 shows that \(\chi^2\) value (479.19) in the above case is larger than that of the table value at 5% significant level. It points out that respondents differ in their opinion significantly. Moreover, the majority of the responding teachers has not accepted the statement therefore the statement, “Demonstration model are presented to the students to explain difficult” is rejected.
Table 37: Home work is regularly given to students

<table>
<thead>
<tr>
<th>Options</th>
<th>A</th>
<th>UD</th>
<th>DA</th>
<th>Total</th>
<th>$\chi^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Responses</td>
<td>511</td>
<td>72</td>
<td>281</td>
<td>864</td>
<td>334.84</td>
</tr>
<tr>
<td>Percentage</td>
<td>59.14%</td>
<td>8.33%</td>
<td>32.52%</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

df=2  Table value of $\chi^2$ at 0.05 level of significance=5.99

![Bar chart showing Options A, UD, DA, Total, and $\chi^2$.]

Table 37 shows that $\chi^2$ value (334.84) in the above case is larger than that of the table value at 5% significant level. It points out that respondents differ in their opinion significantly. Moreover, the majority of the responding teachers has accepted the statement therefore the statement, “Home work is regularly given to students” is accepted.
Table 38: Home work given to students is checked regularly

<table>
<thead>
<tr>
<th>Options</th>
<th>A</th>
<th>UD</th>
<th>DA</th>
<th>Total</th>
<th>$\chi^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Responses</td>
<td>486</td>
<td>81</td>
<td>297</td>
<td>864</td>
<td>285.19</td>
</tr>
<tr>
<td>Percentage</td>
<td>56.25%</td>
<td>9.38%</td>
<td>34.38%</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

df=2  
Table value of $\chi^2$ at 0.05 level of significance=5.99

Table 38 shows that $\chi^2$ value (285.19) in the above case is larger than that of the table value at 5% significant level. It points out that respondents differ in their opinion significantly. Moreover, majority of the responding teachers has accepted therefore the statement “home work given to students is checked regularly” is accepted.
Table 39: Audio video aids are provided for teaching mathematics in the classroom

<table>
<thead>
<tr>
<th>Options</th>
<th>A</th>
<th>UD</th>
<th>DA</th>
<th>Total</th>
<th>( \chi^2 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Responses</td>
<td>212</td>
<td>77</td>
<td>575</td>
<td>864</td>
<td>460.65</td>
</tr>
<tr>
<td>Percentage</td>
<td>24.54%</td>
<td>8.91%</td>
<td>66.55%</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

\( \chi^2 \) = 460.65

\( \chi^2 \) value at 0.05 level of significance = 5.99

Table 39 shows that \( \chi^2 \) value (460.65) in the above case is larger than that of the table value at 5% significant level. It points out that respondents differ in their opinion significantly. Moreover, the majority of the responding teachers has not accepted the statement therefore the statement, “Audio video aids are provided for teaching mathematics in the classroom” is rejected.
Table 40: Students are interested in knowing the application of mathematics in daily life

<table>
<thead>
<tr>
<th>Options</th>
<th>A</th>
<th>UD</th>
<th>DA</th>
<th>Total</th>
<th>$\chi^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Responses</td>
<td>523</td>
<td>105</td>
<td>236</td>
<td>864</td>
<td>317.42</td>
</tr>
<tr>
<td>Percentage</td>
<td>60.53%</td>
<td>12.15%</td>
<td>27.31%</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

df=2  Table value of $\chi^2$ at 0.05 level of significance=5.99

Table 40 shows that $\chi^2$ value (317.42) in the above case is larger than that of the table value at 5% significant level. It points out that respondents differ in their opinion significantly. Moreover, the majority of the responding teachers has accepted the statement therefore the statement, “Students are interested in knowing the application of mathematics in daily life” is accepted.
4.3 EVALUATION

Table 41: Examination for Secondary school mathematics is based upon the items
Which test?

<table>
<thead>
<tr>
<th>Options</th>
<th>A</th>
<th>UD</th>
<th>DA</th>
<th>Total</th>
<th>$\chi^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Achievements of objectives of curriculum</td>
<td>493</td>
<td>114</td>
<td>257</td>
<td>864</td>
<td>254.38</td>
</tr>
<tr>
<td>Percentage</td>
<td>57.06%</td>
<td>13.19%</td>
<td>29.75%</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>Knowledge</td>
<td>509</td>
<td>70</td>
<td>285</td>
<td>864</td>
<td>334.63</td>
</tr>
<tr>
<td>Percentage</td>
<td>58.91%</td>
<td>8.10%</td>
<td>32.99%</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>Comprehension</td>
<td>498</td>
<td>97</td>
<td>269</td>
<td>864</td>
<td>281.05</td>
</tr>
<tr>
<td>Percentage</td>
<td>57.64%</td>
<td>11.23%</td>
<td>31.13%</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>Application</td>
<td>502</td>
<td>84</td>
<td>278</td>
<td>864</td>
<td>303.86</td>
</tr>
<tr>
<td>Percentage</td>
<td>58.10%</td>
<td>9.72%</td>
<td>32.18%</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>Analysis</td>
<td>344</td>
<td>109</td>
<td>411</td>
<td>864</td>
<td>174.67</td>
</tr>
<tr>
<td>Percentage</td>
<td>39.81%</td>
<td>12.62%</td>
<td>47.57%</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>Synthesis</td>
<td>315</td>
<td>93</td>
<td>456</td>
<td>864</td>
<td>232.56</td>
</tr>
<tr>
<td>Percentage</td>
<td>36.46%</td>
<td>10.76%</td>
<td>52.78%</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>Evaluation</td>
<td>327</td>
<td>105</td>
<td>432</td>
<td>864</td>
<td>193.56</td>
</tr>
<tr>
<td>Percentage</td>
<td>37.85%</td>
<td>12.15%</td>
<td>50.00%</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>Scientific process</td>
<td>293</td>
<td>118</td>
<td>453</td>
<td>864</td>
<td>194.97</td>
</tr>
<tr>
<td>Percentage</td>
<td>33.91%</td>
<td>13.66%</td>
<td>52.43%</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>Scientific skills</td>
<td>281</td>
<td>109</td>
<td>474</td>
<td>864</td>
<td>231.55</td>
</tr>
<tr>
<td>Percentage</td>
<td>32.52%</td>
<td>12.62%</td>
<td>54.86%</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>Scientific attitudes</td>
<td>266</td>
<td>130</td>
<td>468</td>
<td>864</td>
<td>200.86</td>
</tr>
<tr>
<td>Percentage</td>
<td>30.79%</td>
<td>15.05%</td>
<td>54.17%</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>Rote learning/memorization</td>
<td>518</td>
<td>103</td>
<td>243</td>
<td>864</td>
<td>309.55</td>
</tr>
<tr>
<td>Percentage</td>
<td>59.95%</td>
<td>11.92%</td>
<td>28.13%</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>Content of the course</td>
<td>397</td>
<td>142</td>
<td>325</td>
<td>864</td>
<td>120.05</td>
</tr>
<tr>
<td>Percentage</td>
<td>45.95%</td>
<td>16.44%</td>
<td>37.62%</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

$df=2$ Table value of $\chi^2$ at 0.05 level of significance=5.99
Achievement of the objectives of the curriculum

Table 41 shows that $\chi^2$ value (254.38) in the above case is larger than that of the table value at 5% significant level. It points out that respondents differ in their opinion significantly. Moreover, the majority of the responding teachers has accepted the statement therefore the statement, “Examination for secondary school mathematics is based upon the items which test achievement of the objectives of the curriculum” is accepted.

Knowledge

Table 41 shows that $\chi^2$ value (334.63) in the above case is larger than that of the table value at 5% significant level. It points out that respondents differ in their opinion significantly. Moreover, the majority of the responding teachers has accepted the statement therefore the statement, “Examination for secondary school mathematics is based upon the items which test knowledge” is accepted.

Comprehension

Table 41 shows that $\chi^2$ value (281.05) in the above case is larger than that of the table value at 5% significant level. It points out that respondents differ in their opinion significantly. Moreover, the majority of the responding teachers has accepted the statement therefore the statement, “Examination for secondary school mathematics is based upon the items which test comprehension” is accepted.

Application

Table 41 shows that $\chi^2$ value (303.86) in the above case is larger than that of the table value at 5% significant level. It points out that respondents differ in their opinion significantly. Moreover, the majority of the responding teachers has accepted the
statement therefore the statement, “Examination for secondary school mathematics is based upon the items which test application” is accepted.

**Analysis**

Table 41 shows that $\chi^2$ value (174.67) in the above case is larger than that of the table value at 5% significant levels. It points out that respondents differ in their opinion significantly. Moreover, the majority of the responding teachers has not accepted the statement therefore the statement, “Examination for secondary school mathematics is based upon the items which test analysis” is rejected.

**Synthesis**

Table 41 shows that $\chi^2$ value (232.56) in the above case is larger than that of the table value at 5% significant level. It points out that respondents differ in their opinion significantly. Moreover, the majority of the responding teachers has not accepted the statement therefore the statement, “Examination for secondary school mathematics is based upon the items which test synthesis” is rejected.

**Evaluation**

Table 41 shows that $\chi^2$ value (193.56) in the above case is larger than that of the table value at 5% significant levels. It points out that respondents differ in their opinion significantly. Moreover, the majority of the responding teachers has not accepted the statement therefore the statement, “Examination for secondary school mathematics is based upon the items which test evaluation” is rejected.

**Scientific process**

Table 41 shows that $\chi^2$ value (194.97) in the above case is larger than that of the table value at 5% significant levels. It points out that respondents differ in their opinion significantly. Moreover, the majority of the responding teachers has not accepted the
statement therefore the statement, “Examination for secondary school mathematics is
based upon the items which test Scientific process” is rejected.

The scientific skills

Table 41 shows that $\chi^2$ value (231.55) in the above case is larger than that of the
table value at 5% significant levels. It points out that respondents differ in their opinion
significantly. Moreover, the majority of the responding teachers has not accepted the
statement therefore the statement, “Examination for secondary school mathematics is
based upon the items which test the scientific skills” is rejected.

Scientific attitude

Table 41 shows that $\chi^2$ value (200.86) in the above case is larger than that of the
table value at 5% significant levels. It points out that respondents differ in their opinion
significantly. Moreover, the majority of the responding teachers has not accepted the
statement therefore the statement, “Examination for secondary school mathematics is
based upon the items which test attitude” is rejected.

Rote learning

Table 41 shows that $\chi^2$ value (309.55) in the above case is larger than that of the
table value at 5% significant levels. It points out that respondents differ in their opinion
significantly. Moreover, the majority of the responding teachers has accepted the
statement therefore the statement, “Examination for secondary school mathematics is
based upon the items which test rote learning” is accepted.

Contents of the course

Table 41 shows that $\chi^2$ value (120.05) in the above case is larger than that of the
table value at 5% significant levels. It points out that respondents differ in their opinion
significantly. Moreover, the majority of the responding teachers has accepted the
statement therefore the statement, “Examination for secondary school mathematics is based upon the items which test contents of the course” is accepted.

**Table 42: Pattern of the choice in the board’s mathematics paper is appropriate**

<table>
<thead>
<tr>
<th>Options</th>
<th>A</th>
<th>UD</th>
<th>DA</th>
<th>Total</th>
<th>( \chi^2 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Responses</td>
<td>457</td>
<td>93</td>
<td>314</td>
<td>864</td>
<td>233.55</td>
</tr>
<tr>
<td>Percentage</td>
<td>52.89%</td>
<td>10.76%</td>
<td>36.34%</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

df=2 

Table value of \( \chi^2 \) at 5% significant level=5.99

Table 42 shows that \( \chi^2 \) value (233.55) in the above case is larger than that of the table value at 5% significant levels. It points out that respondents differ in their opinion significantly. Moreover, the majority of the responding teachers has accepted the statement therefore the statement, “Pattern of the choice in the board’s mathematics paper is appropriate” is accepted.
Table 43: Students are judged in academic year by variety of evaluation patterns

<table>
<thead>
<tr>
<th>Options</th>
<th>A</th>
<th>UD</th>
<th>DA</th>
<th>Total</th>
<th>( \chi^2 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student interest</td>
<td>245</td>
<td>67</td>
<td>552</td>
<td>864</td>
<td>417.01</td>
</tr>
<tr>
<td>Percentage</td>
<td>28.36%</td>
<td>7.75%</td>
<td>63.89%</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>Home work</td>
<td>511</td>
<td>81</td>
<td>272</td>
<td>864</td>
<td>322.34</td>
</tr>
<tr>
<td>Percentage</td>
<td>59.14%</td>
<td>9.38%</td>
<td>31.48%</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>Assignments</td>
<td>249</td>
<td>91</td>
<td>524</td>
<td>864</td>
<td>333.42</td>
</tr>
<tr>
<td>Percentage</td>
<td>28.82%</td>
<td>10.53%</td>
<td>60.65%</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

df=2

Table value of \( \chi^2 \) at 0.05 level of significance=5.99

![Bar chart showing distribution of evaluation patterns for different options.](image-url)
**Student interest**

Table 43 shows that $\chi^2$ value (417.01) in the above case is larger than that of the table value at 5% significant levels. It points out that respondents differ in their opinion significantly. Moreover, the majority of the responding teachers did not accept the statement therefore the statement “Students are judged in academic year by student interest” is rejected.

**Home work**

Table 43 shows that $\chi^2$ value (322.34) in the above case is larger than that of the table value at 5% significant level. It points out that respondents differ in their opinion significantly. Moreover, the majority of the responding teachers has accepted the statement therefore the statement, “Students are judged in academic year by home work” is accepted.

**Assignments**

Table 43 shows that $\chi^2$ value (333.42) in the above case is larger than that of the table value at 5% significant level. It points out that respondents differ in their opinion significantly. Moreover, the majority of the responding teachers did not accept the statement therefore the statement, “Students are judged in academic year by student interest” is rejected.
Table 44: Internal system for testing mathematics curriculum is suitable in our environment

<table>
<thead>
<tr>
<th>Options</th>
<th>A</th>
<th>UD</th>
<th>DA</th>
<th>Total</th>
<th>$\chi^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Responses</td>
<td>459</td>
<td>119</td>
<td>286</td>
<td>864</td>
<td>200.72</td>
</tr>
<tr>
<td>Percentage</td>
<td>53.13%</td>
<td>13.77%</td>
<td>33.10%</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

df=2 Table value of $\chi^2$ at 0.05 level of significance=5.99

![Bar Chart]

Table 44 shows that $\chi^2$ value (200.72) in the above case is larger than that of the table value at 5% significant levels. It points out that respondents differ in their opinion significantly. Moreover, the majority of the responding teachers has accepted the statement therefore the statement, “Internal system for testing mathematics curriculum is suitable in our environment” is accepted.
VI- INSTRUCTIONAL OBJECTIVES (EXPECTED OUTCOMES 9TH CLASS)

UNIT 1

Table 45: Students are able to write a set in set builder notation

<table>
<thead>
<tr>
<th>Options</th>
<th>A</th>
<th>UD</th>
<th>DA</th>
<th>Total</th>
<th>( \chi^2 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Responses</td>
<td>436</td>
<td>125</td>
<td>303</td>
<td>864</td>
<td>169.09</td>
</tr>
<tr>
<td>Percentage</td>
<td>50.46%</td>
<td>14.47%</td>
<td>35.07%</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

\( \chi^2 \) with df=2 is 169.09. Table value of \( \chi^2 \) at 0.05 level of significance=5.99

Table 45 shows that \( \chi^2 \) value (169.09) in the above case is larger than that of the table value at 5% significant levels. It points out that respondents differ in their opinion significantly. Moreover, the majority of the responding teachers has accepted the statement therefore the statement, “Students are able to write a set in the set builder notation” is accepted.
Table 46: Students can verify the property of operation on set

<table>
<thead>
<tr>
<th>Options</th>
<th>A</th>
<th>UD</th>
<th>DA</th>
<th>Total</th>
<th>$\chi^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Closure property</td>
<td>501</td>
<td>114</td>
<td>249</td>
<td>864</td>
<td>267.94</td>
</tr>
<tr>
<td>Percentage</td>
<td>57.99%</td>
<td>13.19%</td>
<td>28.82%</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>Commutative property, Associative property, and distributive property of union over intersection and vice versa</td>
<td>527</td>
<td>100</td>
<td>237</td>
<td>864</td>
<td>330.09</td>
</tr>
<tr>
<td>Percentage</td>
<td>61%</td>
<td>11.57%</td>
<td>27.43%</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>De Morgan’s laws</td>
<td>493</td>
<td>142</td>
<td>229</td>
<td>864</td>
<td>232.02</td>
</tr>
<tr>
<td>Percentage</td>
<td>57.06%</td>
<td>16.44%</td>
<td>26.50%</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

df=2

Table value of $\chi^2$ at 0.05 level of significance=5.99

**Closure property**

Table 46 shows that $\chi^2$ value (267.94) in the above case is larger than that of the table value at 5% significant level. It points out that respondents differ in their opinion significantly. Moreover, the majority of the responding teachers has accepted the


statement therefore the statement, “Students can verify the closure properties of operation on set” is accepted.

**Commutative property, Associative property, and distributive property of union over intersection and vice versa**

Table 46 shows that $\chi^2$ value (330.09) in the above case is larger than that of the table value at 5% significant levels. It points out that respondents differ in their opinion significantly. Moreover, the majority of the responding teachers has accepted the statement therefore the statement, “Students can verify the commutative property, associative property, and distributive property of union over intersection and vice versa properties of operation on set” is accepted.

**De Morgan’s Laws**

Table 46 shows that $\chi^2$ value (232.09) in the above case is larger than that of the table value at 5% significant levels. It points out that respondents differ in their opinion significantly. Moreover, the majority of the responding teachers has accepted the statement therefore the statement, “Students can verify the De Morgan’s Laws properties of operation on set” is accepted.
Table 47: Students can verify the property of operation on set using Venn diagram

<table>
<thead>
<tr>
<th>Options</th>
<th>A</th>
<th>UD</th>
<th>DA</th>
<th>Total</th>
<th>$\chi^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Closure property</td>
<td>489</td>
<td>117</td>
<td>258</td>
<td>864</td>
<td>244.94</td>
</tr>
<tr>
<td>Percentage</td>
<td>56.6%</td>
<td>13.54%</td>
<td>29.86%</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>Commutative property, Associative property, and distributive property of union over intersection and vice versa</td>
<td>514</td>
<td>124</td>
<td>226</td>
<td>864</td>
<td>284.08</td>
</tr>
<tr>
<td>Percentage</td>
<td>59.49%</td>
<td>14.35%</td>
<td>26.16%</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>De Morgan’s laws</td>
<td>278</td>
<td>135</td>
<td>451</td>
<td>864</td>
<td>173.88</td>
</tr>
<tr>
<td>Percentage</td>
<td>32.18%</td>
<td>15.63%</td>
<td>52.20%</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

$df=2$  
Table value of $\chi^2$ at 0.05 level of significance=5.99

![Chart showing the distribution of responses for each property of set operation verified using Venn diagrams.](chart.png)
**Closure property**

Table 47 shows that $\chi^2$ value (244.94) in the above case is larger than that of the table value at 5% significant level. It points out that respondents differ in their opinion significantly. Moreover, the majority of the responding teachers has accepted the statement therefore the statement, “Student can verify the closure property of set using Venn diagram” is accepted.

**Commutative property, Associative property, and Distributive property of union over intersection and vice versa**

Table 47 shows that $\chi^2$ value (284.08) in the above case is larger than that of the table value at 5% significant levels. It points out that respondents differ in their opinion significantly. Moreover, the majority of the responding teachers has accepted the statement therefore the statement, “students can verify the commutative property, associative property, and distributive property of union over intersection and vice versa using Venn diagram” is accepted.

**De Morgan’s laws**

Table 47 shows that $\chi^2$ value (173.88) in the above case is larger than that of the table value at 5% significant levels. It points out that respondents differ in their opinion significantly. Moreover, the majority of the responding teachers has not accepted the statement therefore the statement, “students can verify the De Morgan’s laws using Venn diagram” is rejected.
Table 48: Students are able to write ordered pairs, Cartesian product and binary relations

<table>
<thead>
<tr>
<th>Options</th>
<th>A</th>
<th>UD</th>
<th>DA</th>
<th>Total</th>
<th>$\chi^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Responses</td>
<td>529</td>
<td>116</td>
<td>219</td>
<td>864</td>
<td>320.92</td>
</tr>
<tr>
<td>Percentage</td>
<td>61.23%</td>
<td>13.43%</td>
<td>25.35%</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

The table shows that the $\chi^2$ value for the observed data is 320.92, which is significantly higher than the critical value of 5.99 at the 0.05 level of significance. This indicates a significant difference in the responses. Moreover, the teachers' opinions were ordered and binary, and the correspondence in the data. Since the $\chi^2$ value is greater than the critical value, we can conclude that the respondents differ in their opinion significantly. Therefore, the statement “Students are able to write ordered pairs, cartesian product and binary relations” is accepted.
Table 49: Students can define and write function and its kinds (into, onto, one –to-one, and Bijective)

<table>
<thead>
<tr>
<th>Options</th>
<th>A</th>
<th>UD</th>
<th>DA</th>
<th>Total</th>
<th>$\chi^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Responses</td>
<td>217</td>
<td>145</td>
<td>502</td>
<td>864</td>
<td>247.52</td>
</tr>
<tr>
<td>Percentage</td>
<td>25.12%</td>
<td>16.78%</td>
<td>58.10%</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

df=2  Table value of $\chi^2$ at 0.05 level of significance=5.99

Table 49 shows that $\chi^2$ (247.52) value in the above case is larger than that of the table value at 5% significant level. It points out that respondents differ in their opinion significantly. Moreover, the majority of the responding teachers did not accept the statement therefore the statement “Students can define and write function and its kinds (into, onto, one –to-one, and bijective)” is rejected.
Table 50: Students can read and plot the points in the Cartesian plane and know the fact that there is one to one correspondence between points on the plane and the ordered pairs represented by RxR

<table>
<thead>
<tr>
<th>Options</th>
<th>A</th>
<th>UD</th>
<th>DA</th>
<th>Total</th>
<th>$\chi^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Responses</td>
<td>468</td>
<td>154</td>
<td>242</td>
<td>864</td>
<td>182.19</td>
</tr>
<tr>
<td>Percentage</td>
<td>54.17%</td>
<td>17.82%</td>
<td>28.01%</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

df=2  Table value of $\chi^2$ at 0.05 level of significance=5.99

Table 50 shows that $\chi^2$ value in the above case is larger than that of the table value at 5% significant levels. It points out that respondents differ in their opinion significantly. Moreover, the majority of the responding teachers has accepted the statement therefore the statement, “Students can read and plot the points in the Cartesian product and know the fact that there is one to one correspondence between points on the plane and the ordered pairs represented by RxR” is accepted.
UNIT 2: SYSTEM OF REAL NUMBER

Table 51: Students know and write properties of real numbers

<table>
<thead>
<tr>
<th>Options</th>
<th>A</th>
<th>UD</th>
<th>DA</th>
<th>Total</th>
<th>( \chi^2 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Responses</td>
<td>517</td>
<td>81</td>
<td>266</td>
<td>864</td>
<td>332.55</td>
</tr>
<tr>
<td>Percentage</td>
<td>59.84%</td>
<td>9.37%</td>
<td>30.79%</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

\( \text{df=2} \)

Table value of \( \chi^2 \) at 0.05 level of significance=5.99

Table 51 shows that \( \chi^2 \) value in the above case is larger than that of the table value at 5% significant level. It points out that respondents differ in their opinion significantly. Moreover, the majority of the responding teachers has accepted the statement therefore the statement, “Students can know and write properties of real numbers” is accepted.
Table 52: Students have the concept of surds and can find the conjugate of surds

<table>
<thead>
<tr>
<th>Options</th>
<th>A</th>
<th>UD</th>
<th>DA</th>
<th>Total</th>
<th>$\chi^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Responses</td>
<td>499</td>
<td>102</td>
<td>263</td>
<td>864</td>
<td>276.88</td>
</tr>
<tr>
<td>Percentage</td>
<td>57.75%</td>
<td>11.81%</td>
<td>30.44%</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

df=2 Table value of $\chi^2$ at 0.05 level of significance=5.99

Table 52 shows that $\chi^2$ value in the above case is larger than that of the table value at 5% significant level. It points out that respondents differ in their opinion significantly. Moreover, the majority of the responding teachers has accepted the statement therefore the statement, “Students have the concept of surds and can find the conjugate of surds” is accepted.
Table 53: Students can evaluate the expression of the types of $X^2+1/X^2, X^4+1/X^4$ where X is a surd by rationalization

<table>
<thead>
<tr>
<th>Options</th>
<th>A</th>
<th>UD</th>
<th>DA</th>
<th>Total</th>
<th>$\chi^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Responses</td>
<td>471</td>
<td>141</td>
<td>252</td>
<td>864</td>
<td>195.81</td>
</tr>
<tr>
<td>Percentage</td>
<td>54.51%</td>
<td>16.32%</td>
<td>29.17%</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

$df=2$ Table value of $\chi^2$ at 0.05 level of significance=5.99

Table 53 shows that $\chi^2$ value in the above case is larger than that of the table value at 5% significant levels. It points out that respondents differ in their opinion significantly. Moreover, the majority of the responding teachers has accepted the statement therefore the statement, “Students can evaluate the expression of the types of $X^2+1/X^2, X^4+1/X^4$ where X is a surd by rationalization” is accepted.
Table 54: Students can know the laws of exponents of real numbers and can apply them in simplification of the expressions containing them

<table>
<thead>
<tr>
<th>Options</th>
<th>A</th>
<th>UD</th>
<th>DA</th>
<th>Total</th>
<th>$\chi^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Responses</td>
<td>454</td>
<td>149</td>
<td>261</td>
<td>864</td>
<td>165.30</td>
</tr>
<tr>
<td>Percentage</td>
<td>52.55%</td>
<td>17.25%</td>
<td>30.21%</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

df=2  Table value of $\chi^2$ at 0.05 level of significance=5.99

Table 54 shows that $\chi^2$ value in the above case is larger than that of the table value at 5% significant levels. It points out that respondents differ in their opinion significantly. Moreover, the majority of the responding teachers has accepted the statement therefore the statement, “Students can know the laws of exponents of real numbers and can apply them in simplification of the expressions containing them” is accepted.
UNIT 3: LOGARITHM

Table 55: Students can write numbers in scientific notations

<table>
<thead>
<tr>
<th>Options</th>
<th>A</th>
<th>UD</th>
<th>DA</th>
<th>Total</th>
<th>$\chi^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Responses</td>
<td>482</td>
<td>136</td>
<td>246</td>
<td>864</td>
<td>217.03</td>
</tr>
<tr>
<td>Percentage</td>
<td>55.79%</td>
<td>15.74%</td>
<td>28.47%</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

df=2

Table value of $\chi^2$ at 0.05 level of significance=5.99

Table 55 shows that $\chi^2$ value in the above case is larger than that of the table value at 5% significant levels. It points out that respondents differ in their opinion significantly. Moreover, the majority of the responding teachers has accepted the statement therefore the statement; “Students can write numbers in scientific notations” is accepted.
Table 56: Have the concepts of log and anti log, can write the characteristics and mantissa and find its anti log

<table>
<thead>
<tr>
<th>Options</th>
<th>A</th>
<th>UD</th>
<th>DA</th>
<th>Total</th>
<th>$\chi^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Responses</td>
<td>504</td>
<td>121</td>
<td>239</td>
<td>864</td>
<td>267.17</td>
</tr>
<tr>
<td>Percentage</td>
<td>58.33%</td>
<td>14.00%</td>
<td>27.66%</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

Table 56 shows that $\chi^2$ value in the above case is larger than that of the table value at 5% significant levels. It points out that respondents differ in their opinion significantly. Moreover, the majority of the responding teachers has accepted the statement therefore the statement, “Have the concepts of log and anti log, can write the characteristics and mantissa and find its anti log” is accepted.
Table 57: Students can prove the laws of logarithms and apply them in computation of simple and harder problems

<table>
<thead>
<tr>
<th>Options</th>
<th>A</th>
<th>UD</th>
<th>DA</th>
<th>Total</th>
<th>( \chi^2 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Responses</td>
<td>423</td>
<td>152</td>
<td>289</td>
<td>864</td>
<td>127.51</td>
</tr>
<tr>
<td>Percentage</td>
<td>48.96%</td>
<td>17.59%</td>
<td>33.45%</td>
<td>100%</td>
<td>127.51</td>
</tr>
</tbody>
</table>

df=2  Table value of \( \chi^2 \) at 0.05 level of significance=5.99

Table 57 shows that \( \chi^2 \) value in the above case is larger than that of the table value at 5% significant levels. It points out that respondents differ in their opinion significantly. Moreover, the majority of the responding teachers has accepted the statement therefore the statement, “Students can prove the laws of logarithms and apply them in computation of simple and harder problems” is accepted.
UNIT 4: ALGEBRAIC EXPRESSION

Table 58: Students can solve harder cases of division of algebraic expressions

<table>
<thead>
<tr>
<th>Options</th>
<th>A</th>
<th>UD</th>
<th>DA</th>
<th>Total</th>
<th>( \chi^2 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Responses</td>
<td>435</td>
<td>142</td>
<td>287</td>
<td>864</td>
<td>149.05</td>
</tr>
<tr>
<td>Percentage</td>
<td>50.35%</td>
<td>16.44%</td>
<td>33.22%</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

\[ \chi^2 \text{ at } 0.05 \text{ level of significance } = 5.99 \]

Table 58 shows that \( \chi^2 \) value in the above case is larger than that of the table value at 5% significant levels. It points out that respondents differ in their opinion significantly.

Moreover, the majority of the responding teachers has accepted the statement therefore the statement, “Students can solve harder cases of division of algebraic expressions” is accepted.
Table 59: Students can establish and apply the following formulae:

<table>
<thead>
<tr>
<th>Options</th>
<th>A</th>
<th>UD</th>
<th>DA</th>
<th>Total</th>
<th>$\chi^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$(a+b+c)^2 = a^2 + b^2 + c^2 + 2ab + 2bc + 2ca$</td>
<td>518</td>
<td>102</td>
<td>244</td>
<td>864</td>
<td>310.53</td>
</tr>
<tr>
<td>Percentage</td>
<td>59.95%</td>
<td>11.81%</td>
<td>28.24%</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>$(a+b)^3 = a^3 + b^3 + 3ab(a+b)$</td>
<td>259</td>
<td>122</td>
<td>483</td>
<td>864</td>
<td>230.63</td>
</tr>
<tr>
<td>Percentage</td>
<td>29.98%</td>
<td>14.12%</td>
<td>55.90%</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>$a^3 + b^3 = (a+b)(a^2 - ab + b^2)$</td>
<td>304</td>
<td>107</td>
<td>453</td>
<td>864</td>
<td>209.17</td>
</tr>
<tr>
<td>Percentage</td>
<td>35.19%</td>
<td>12.38%</td>
<td>52.43%</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>$a^3 + b^3 + c^3 - 3abc = (a+b+c)(a^2 + b^2 + c^2 - ab - bc - ca)$</td>
<td>264</td>
<td>118</td>
<td>482</td>
<td>864</td>
<td>233.03</td>
</tr>
<tr>
<td>Percentage</td>
<td>30.56%</td>
<td>13.66%</td>
<td>55.79%</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

$df=2$ Table value of $\chi^2$ at 0.05 level of significance=5.99
Table 59 shows that $\chi^2$ value in the above case is larger than that of the table value at 5% significant levels. It points out that respondents differ in their opinion significantly. Moreover, the majority of the responding teachers has accepted the statement therefore the statement, “Students can establish and apply the formula $(a+b+c)^2 = a^2 + b^2 + c^2 + 2ab + 2bc + 2ca$” is accepted.

$(a+b)^3 = a^3 + b^3 + 3ab(a+b)$

Table 59 shows that $\chi^2$ value in the above case is larger than that of the table value at 5% significant levels. It points out that respondents differ in their opinion significantly. Moreover, the majority of the responding teachers did not accept the statement therefore the statement “Students can establish and apply the formula $(a+b)^3 = a^3 + b^3 + 3ab(a+b)$” is rejected.

$a^3 + b^3 + c^3 - 3abc = (a+b+c)(a^2 + b^2 + c^2 - ab - bc - ca)$

Table 59 shows that $\chi^2$ value in the above case is larger than that of the table value at 5% significant levels. It points out that respondents differ in their opinion significantly. Moreover, the majority of the responding teachers did not accept the statement therefore the statement, “Students can establish and apply the formula $a^3 + b^3 + c^3 - 3abc = (a+b+c)(a^2 + b^2 + c^2 - ab - bc - ca)$” is rejected.
UNIT 5: FACTORIZATION, HCF, LCM, SIMPLIFICATION AND SQUARE ROOT

Table 60: Students can factorize the following types of expressions

<table>
<thead>
<tr>
<th>Options</th>
<th>A</th>
<th>UD</th>
<th>DA</th>
<th>Total</th>
<th>$\chi^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>expressions reducible to $a^2-b^2$ form, $ax^2+bx+c$</td>
<td>334</td>
<td>125</td>
<td>405</td>
<td>864</td>
<td>147.13</td>
</tr>
<tr>
<td>percentage</td>
<td>38.66%</td>
<td>14.47%</td>
<td>46.88%</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>expression in cyclic order</td>
<td>215</td>
<td>104</td>
<td>545</td>
<td>864</td>
<td>365.40</td>
</tr>
<tr>
<td>percentage</td>
<td>24.88%</td>
<td>12.04%</td>
<td>63.08%</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>expression requiring the application of factor theorem</td>
<td>276</td>
<td>97</td>
<td>491</td>
<td>864</td>
<td>270.26</td>
</tr>
<tr>
<td>percentage</td>
<td>31.94%</td>
<td>11.23%</td>
<td>56.83%</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

$\text{df}=2$                                                                 
Table value of $\chi^2$ at 0.05 level of significance=5.99

![Graph showing the distribution of different types of expressions and their percentages]
Expressions reducible to \(a^2-b^2\) form, \(ax^2+b+c\), \(a^3+b^3\), \(a^3+b^3+c^3-3abc\)

Table 60 shows that \(\chi^2\) value in the above case is larger than that of the table value at 5% significant levels. It points out that respondents differ in their opinion significantly. Moreover, the majority of the responding teachers has not accepted the statement, therefore the statement, “Students can factorize the expressions reducible to \(a^2-b^2\) form, \(ax^2+b+c\), \(a^3+b^3\), \(a^3+b^3+c^3-3abc\)” is rejected.

Expression in cyclic order

Table 60 shows that \(\chi^2\) value in the above case is larger than that of the table value at 5% significant levels. It points out that respondents differ in their opinion significantly. Moreover, the majority of the responding teachers did not accept the statement therefore the statement “Students can factorize the expressions expression in cyclic order” is rejected.

Expression requiring the application of factor theorem

Table 60 shows that \(\chi^2\) value in the above case is larger than that of the table value at 5% significant levels. It points out that respondents differ in their opinion significantly. Moreover, the majority of the responding teachers did not accept the statement therefore the statement “Students can factorize the expressions reducible to \(a^2-b^2\) form, \(ax^2+b+c\), \(a^3+b^3\), \(a^3+b^3+c^3-3abc\)” is rejected.
Table 61: Students can find the HCF, and LCM of algebraic expression

<table>
<thead>
<tr>
<th>Options</th>
<th>A</th>
<th>UD</th>
<th>DA</th>
<th>Total</th>
<th>$\chi^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>By factorization</td>
<td>519</td>
<td>107</td>
<td>238</td>
<td>864</td>
<td>307.72</td>
</tr>
<tr>
<td>Percentage</td>
<td>60.07%</td>
<td>12.38%</td>
<td>27.55%</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>By division</td>
<td>531</td>
<td>114</td>
<td>219</td>
<td>864</td>
<td>326.69</td>
</tr>
<tr>
<td>Percentage</td>
<td>61.46%</td>
<td>13.19%</td>
<td>25.35%</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

df=2

Table value of $\chi^2$ at 0.05 level of significance=5.99
By Factorization

Table 61 shows that $\chi^2$ value in the above case is larger than that of the table value at 5% significant levels. It points out that respondents differ in their opinion significantly. Moreover, the majority of the responding teachers has accepted the statement therefore the statement, “Students can find the HCF, and LCM of algebraic expression by factorization” is accepted.

By Division

Table 61 shows that $\chi^2$ value in the above case is larger than that of the table value at 5% significant levels. It points out that respondents differ in their opinion significantly. Moreover, the majority of the responding teachers has accepted the proclamation therefore the proclamation, “Students can find the HCF, and LCM of algebraic expression by division” is accepted.
Table 62: Students can simplify the algebraic expressions

<table>
<thead>
<tr>
<th>Options</th>
<th>A</th>
<th>UD</th>
<th>DA</th>
<th>Total</th>
<th>(\chi^2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Responses</td>
<td>517</td>
<td>124</td>
<td>223</td>
<td>864</td>
<td>290.15</td>
</tr>
<tr>
<td>Percentage</td>
<td>59.83%</td>
<td>14.35%</td>
<td>25.81%</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

df=2  
Table value of \(\chi^2\) at 0.05 level of significance=5.99

Table 62 shows that \(\chi^2\) value in the above case is larger than that of the table value at 5% significant levels. It points out that respondents differ in their opinion significantly. Moreover, the majority of the responding teachers has accepted the proclamation therefore the proclamation, “Students can simplify the algebraic expressions” is accepted.
Table 63: Students can find the square roots of algebraic expressions by;

<table>
<thead>
<tr>
<th>Options</th>
<th>A</th>
<th>UD</th>
<th>DA</th>
<th>Total</th>
<th>$\chi^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Factorization</td>
<td>490</td>
<td>127</td>
<td>247</td>
<td>864</td>
<td>237.52</td>
</tr>
<tr>
<td>Percentage</td>
<td>56.71%</td>
<td>14.70%</td>
<td>28.59%</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>Division</td>
<td>463</td>
<td>108</td>
<td>293</td>
<td>864</td>
<td>218.92</td>
</tr>
<tr>
<td>Percentage</td>
<td>53.59%</td>
<td>12.50%</td>
<td>33.91%</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

$df=2$  
Table value of $\chi^2$ at 0.05 level of significance = 5.99
By Factorization

Table 63 shows that $\chi^2$ value in the above case is larger than that of the table value at 5% significant level. It points out that respondents differ in their opinion significantly. Moreover, the majority of the responding teachers has accepted the proclamation therefore the proclamation is accepted.

By Division

Table 63 shows that $\chi^2$ value in the above case is larger than that of the table value at 5% significant level. It points out that respondents differ in their opinion significantly. Moreover, the majority of the responding teachers has accepted the proclamation therefore the proclamation, “Students can find the square roots of algebraic expressions by division” is accepted.
UNIT 6: MATRICES

Table 64: Students can learn the concept of a matrix, its rows, columns, order and types of matrices

<table>
<thead>
<tr>
<th>Options</th>
<th>A</th>
<th>UD</th>
<th>DA</th>
<th>Total</th>
<th>( \chi^2 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Responses</td>
<td>521</td>
<td>128</td>
<td>215</td>
<td>864</td>
<td>295.9</td>
</tr>
<tr>
<td>Percentage</td>
<td>60.30%</td>
<td>14.81%</td>
<td>24.88%</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

\( df=2 \)  Table value of \( \chi^2 \) at 0.05 level of significance=5.99

Table 64 shows that \( \chi^2 \) value in the above case is larger than that of the table value at 5% significant level. It points out that respondents differ in their opinion significantly. Moreover, the majority of the responding teachers has accepted the proclamation therefore the proclamation, “Students can learn the concept of a matrix, its rows, columns, order and types of matrices” is accepted.
Table 65: Students can add, subtract, and multiply matrices, know that the multiplication of matrices is associative but not commutative in general

<table>
<thead>
<tr>
<th>Options</th>
<th>A</th>
<th>UD</th>
<th>DA</th>
<th>Total</th>
<th>( \chi^2 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Responses</td>
<td>441</td>
<td>184</td>
<td>239</td>
<td>864</td>
<td>127.17</td>
</tr>
<tr>
<td>Percentage</td>
<td>51.04%</td>
<td>21.30%</td>
<td>27.66%</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

df=2

Table value of \( \chi^2 \) at 0.05 level of significance = 5.99

Table 65 shows that \( \chi^2 \) value in the above case is larger than that of the table value at 5% significant level. It points out that respondents differ in their opinion significantly. Moreover, the majority of the responding teachers has accepted the proclamation therefore the proclamation, “Students can add, subtract, and multiply matrices, know that the multiplication of matrices is associative but not commutative in general” is accepted.
Table 66: Students know the multiplicative and additive identities of matrices

<table>
<thead>
<tr>
<th>Options</th>
<th>A</th>
<th>UD</th>
<th>DA</th>
<th>Total</th>
<th>$\chi^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Responses</td>
<td>478</td>
<td>134</td>
<td>252</td>
<td>864</td>
<td>212.19</td>
</tr>
<tr>
<td>Percentage</td>
<td>55.32%</td>
<td>15.51%</td>
<td>29.17%</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

Table 66 shows that $\chi^2$ value in the above case is larger than that of the table value at 5% significant level. It points out that respondents differ in their opinion significantly. Moreover, the majority of the responding teachers has accepted the proclamation therefore the proclamation, “Students know the multiplicative and additive identities of matrices” is accepted.
Table 67: Students can distinguish between singular and non singular matrices

<table>
<thead>
<tr>
<th>Options</th>
<th>A</th>
<th>UD</th>
<th>DA</th>
<th>Total</th>
<th>$\chi^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Responses</td>
<td>481</td>
<td>118</td>
<td>265</td>
<td>864</td>
<td>231.52</td>
</tr>
<tr>
<td>Percentage</td>
<td>55.67%</td>
<td>13.66%</td>
<td>30.67%</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

df=2 \quad \text{Table value of } \chi^2 \text{ at 0.05 level of significance}=5.99

Table 67 shows that $\chi^2$ value in the above case is larger than that of the table value at 5% significant level. It points out that respondents differ in their opinion significantly. Moreover, the majority of the responding teachers has accepted the proclamation therefore the proclamation, “Students can distinguish between singular and non singular matrices” is accepted.
Table 68: Students can find the multiplicative and additive inverse of matrices

<table>
<thead>
<tr>
<th>Options</th>
<th>A</th>
<th>UD</th>
<th>DA</th>
<th>Total</th>
<th>$\chi^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Responses</td>
<td>472</td>
<td>115</td>
<td>277</td>
<td>864</td>
<td>221.90</td>
</tr>
<tr>
<td>Percentage</td>
<td>54.62%</td>
<td>13.31%</td>
<td>32.06%</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

df=2  

Table value of $\chi^2$ at 0.05 level of significance=5.99

Table 68 shows that $\chi^2$ value in the above case is larger than that of the table value at 5% significant level. It points out that respondents differ in their opinion significantly. Moreover, the majority of the responding teachers has accepted the proclamation therefore the proclamation, “Students can find the multiplicative and additive inverse of matrices” is accepted.
Table 69: Students can solve two linear equations using

<table>
<thead>
<tr>
<th>Options</th>
<th>A</th>
<th>UD</th>
<th>DA</th>
<th>Total</th>
<th>$\chi^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Matrices</td>
<td>451</td>
<td>121</td>
<td>292</td>
<td>864</td>
<td>189.15</td>
</tr>
<tr>
<td>Percentage</td>
<td>52.20%</td>
<td>14%</td>
<td>33.8%</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>Crammer’s rule</td>
<td>479</td>
<td>144</td>
<td>241</td>
<td>864</td>
<td>206.34</td>
</tr>
<tr>
<td>Percentage</td>
<td>55.44%</td>
<td>16.67%</td>
<td>27.89%</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

\( df = 2 \)  

Table value of $\chi^2$ at 0.05 level of significance = 5.99
Matrices

Table 69 shows that $\chi^2$ value in the above case is larger than that of the table value at 5% significant level. It points out that respondents differ in their opinion significantly. Moreover, the majority of the responding teachers has accepted the proclamation therefore the proclamation, “Students can solve two linear equations using matrices” is accepted.

Crammer’s rule

Table 69 shows that $\chi^2$ value in the above case is larger than that of the table value at 5% significant level. It points out that respondents differ in their opinion significantly. Moreover, the majority of the responding teachers has accepted the proclamation therefore the proclamation, “Students can solve two linear equations using Crammer’s rule” is accepted.
UNIT 7: FUNDAMENTAL CONCEPTS OF GEOMETRY

Table 70: Students know the postulates which are used in the study of demonstrative geometry

<table>
<thead>
<tr>
<th>Options</th>
<th>A</th>
<th>UD</th>
<th>DA</th>
<th>Total</th>
<th>( \chi^2 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Responses</td>
<td>227</td>
<td>128</td>
<td>509</td>
<td>864</td>
<td>271.40</td>
</tr>
<tr>
<td>Percentage</td>
<td>26.27%</td>
<td>14.81%</td>
<td>58.91%</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

\( df=2 \)  \quad \text{Table value of } \chi^2 \text{ at 0.05 level of significance}=5.99

Table 70 shows that \( \chi^2 \) value in the above case is larger than that of the table value at 5% significant level. It points out that respondents differ in their opinion significantly. Moreover, the majority of the responding teachers did not accept the proclamation therefore the proclamation “Students know the postulates which are used in the study of demonstrative geometry” is rejected.
### Table 71: Students has the concept of geometrical theorems and its proof

<table>
<thead>
<tr>
<th>Options</th>
<th>A</th>
<th>UD</th>
<th>DA</th>
<th>Total</th>
<th>( \chi^2 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Responses</td>
<td>222</td>
<td>83</td>
<td>559</td>
<td>864</td>
<td>416.05</td>
</tr>
<tr>
<td>Percentage</td>
<td>25.69%</td>
<td>9.61%</td>
<td>64.7%</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

*df=2*  
Table value of \( \chi^2 \) at 0.05 level of significance=5.99

Table 71 shows that \( \chi^2 \) value in the above case is larger than that of the table value at 5% significant level. It points out that respondents differ in their opinion significantly. Moreover, the majority of the responding teachers did not accept the statement therefore the proclamation “Students has the concept of geometrical theorems and its proof” is rejected.
Table 72: Students use deductive reasoning in proving geometrical theorems effectively

<table>
<thead>
<tr>
<th>Options</th>
<th>A</th>
<th>UD</th>
<th>DA</th>
<th>Total</th>
<th>( \chi^2 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Responses</td>
<td>191</td>
<td>88</td>
<td>585</td>
<td>864</td>
<td>477.84</td>
</tr>
<tr>
<td>Percentage</td>
<td>22.11%</td>
<td>10.19%</td>
<td>67.71%</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

df=2

Table value of \( \chi^2 \) at 0.05 level of significance=5.99

Table 72 shows that \( \chi^2 \) value in the above case is larger than that of the table value at 5% significant level. It points out that respondents differ in their opinion significantly. Moreover, the majority of the responding teachers did not accept the statement therefore the proclamation, “Students use deductive reasoning in proving geometrical theorems effectively” is rejected.
UNIT 8 & 9: DEMONSTRATIVE AND PRACTICAL GEOMETRY

Table 73: Students know and apply following methods

<table>
<thead>
<tr>
<th>Options</th>
<th>A</th>
<th>UD</th>
<th>DA</th>
<th>Total</th>
<th>$\chi^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analytic</td>
<td>275</td>
<td>117</td>
<td>472</td>
<td>864</td>
<td>219.67</td>
</tr>
<tr>
<td>Percentage</td>
<td>31.83%</td>
<td>13.54%</td>
<td>54.63%</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>Synthetic</td>
<td>254</td>
<td>109</td>
<td>501</td>
<td>864</td>
<td>272.8</td>
</tr>
<tr>
<td>Percentage</td>
<td>29.40%</td>
<td>12.62%</td>
<td>57.99%</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>Reduction and absurdum</td>
<td>250</td>
<td>122</td>
<td>492</td>
<td>864</td>
<td>245.19</td>
</tr>
<tr>
<td>Percentage</td>
<td>28.94%</td>
<td>14.12%</td>
<td>56.94%</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

$df=2$                                           Table value of $\chi^2$ at 0.05 level of significance=5.99
Analytic

Table 73 shows that $\chi^2$ value in the above case is larger than that of the table value at 5% significant level. It points out that respondents differ in their opinion significantly. Moreover, the majority of the responding teachers has not accepted the statement therefore the proclamation, “Students know and apply analytic method” is rejected.

Synthetic

Table 73 shows that $\chi^2$ value in the above case is larger than that of the table value at 5% significant level. It points out that respondents differ in their opinion significantly. Moreover, the majority of the responding teachers did not accept the statement therefore the proclamation “Students know and apply synthetic method” is rejected.

Reduction and absurdum

Table 73 shows that $\chi^2$ value in the above case is larger than that of the table value at 5% significant level. It points out that respondents differ in their opinion significantly. Moreover, the majority of the responding teachers did not accept the statement therefore the proclamation “Students know and apply reduction and absurdum method” is rejected.
Table 74: Students can prove theorems and apply them in proving their riders

<table>
<thead>
<tr>
<th>Options</th>
<th>A</th>
<th>UD</th>
<th>DA</th>
<th>Total</th>
<th>( \chi^2 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Responses</td>
<td>201</td>
<td>139</td>
<td>524</td>
<td>864</td>
<td>296.76</td>
</tr>
<tr>
<td>Percentage</td>
<td>23.26%</td>
<td>16.09%</td>
<td>60.65%</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

df=2  
Table value of \( \chi^2 \) at 0.05 level of significance=5.99

Table 74 shows that \( \chi^2 \) value in the above case is larger than that of the table value at 5% significant level. It points out that respondents differ in their opinion significantly. Moreover, the majority of the responding teachers did not accept the statement therefore the proclamation “Students can prove theorems and apply them in proving their riders” is rejected.
Table 75: Students can construct the triangles (including ambiguous case)

<table>
<thead>
<tr>
<th>Options</th>
<th>A</th>
<th>UD</th>
<th>DA</th>
<th>Total</th>
<th>$\chi^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Responses</td>
<td>438</td>
<td>106</td>
<td>320</td>
<td>864</td>
<td>196.69</td>
</tr>
<tr>
<td>Percentage</td>
<td>50.69%</td>
<td>12.27%</td>
<td>37.04%</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

df=2  

Table value of $\chi^2$ at 0.05 level of significance=5.99

Table 75 shows that $\chi^2$ value in the above case is larger than that of the table value at 5% significant level. It points out that respondents differ in their opinion significantly. Moreover, the majority of the responding teachers has accepted the statement therefore the proclamation, “Students can construct the triangles (including ambiguous case)” is accepted
Table 76: Students can draw right bisector of sides and bisector of angles of triangle, and the median and altitude of sides of a triangle.

<table>
<thead>
<tr>
<th>Options</th>
<th>A</th>
<th>UD</th>
<th>DA</th>
<th>Total</th>
<th>$\chi^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right Bisector of sides of triangle</td>
<td>448</td>
<td>118</td>
<td>298</td>
<td>864</td>
<td>189.58</td>
</tr>
<tr>
<td>Percentage</td>
<td>51.85%</td>
<td>13.66%</td>
<td>34.49%</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>Bisector of angles of triangle</td>
<td>468</td>
<td>136</td>
<td>260</td>
<td>864</td>
<td>195.44</td>
</tr>
<tr>
<td>Percentage</td>
<td>54.17%</td>
<td>15.74%</td>
<td>30.09%</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>Median of sides of triangle</td>
<td>424</td>
<td>148</td>
<td>292</td>
<td>864</td>
<td>132.33</td>
</tr>
<tr>
<td>Percentage</td>
<td>49.07%</td>
<td>17.13%</td>
<td>33.80%</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>Altitudes of sides of triangle</td>
<td>415</td>
<td>142</td>
<td>307</td>
<td>864</td>
<td>131.27</td>
</tr>
<tr>
<td>Percentage</td>
<td>48.03%</td>
<td>16.44%</td>
<td>35.53%</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

$df=2$  
Table value of $\chi^2$ at 0.05 level of significance = 5.99

Table 76 shows that $\chi^2$ value in the above case is larger than that of the table value at 5% significant level. It points out that respondents differ in their opinion.

150
significantly. Moreover, the majority of the responding teachers has accepted the statement therefore the proclamation, “Students can draw right bisector of sides and bisector of angles of triangle, and the median and altitude of sides of a triangle” is accepted.

4.4 OPEN ENDED QUESTIONS ANALYSIS

1. What are the Major drawbacks in existing Secondary School Mathematics curriculum for class 9th?
   - Present Curriculum is outdated.
   - Same curriculum for Arts & Science students.
   - Lack of practice questions using difficult formulae.
   - Un-interesting and insufficient.
   - No fill in the banks/ matching items.
   - Insufficient examples, existing examples have no relation with common life.
   - Too lengthy and difficult.
   - Subjective in nature.
   - Does not build the problem solving skills and creativity among students.
   - Geometrical portion particularly exercises too lengthy and difficult.

2. In your opinion what are the difficult areas in existing secondary school Mathematics curriculum for class 9th students.
   - Finding solution set of simultaneous equation by graph method.
   - Proof and exercises of geometrical theorems.
   - Unit No. 5 Factorization by Cycles order.
   - Functions.
   - Logical Reasoning (in proving theorems).
• 4th law of logarithm.
• Remainder theorem (factorization).
• Drawing altitudes & medians of triangles.

3. **Suggestions to overcome above mentioned difficulties.**
• Must be updated on regular basis.
• There may be separate curriculum for Arts & Science as it was previously in practice.
• Sufficient practice questions be incorporated with interesting examples from daily life.
• There may be use of one or two formulae in one exercise.
• The Geometrical portion may be minimized.
• More emphasis may be given on objectivity rather than subjectivity.
• Multi textbook culture may be adopted to inculcate problem solving skill, and creativity among the students.
• Latest equipments be provided to the schools for the teaching of mathematics.
• Trained & qualified teachers be appointed.
• Examination may be focused on concept learning rather them cramming.
• Internal system of evaluation be also initiated.
• Participation of actual practicing teachers be ensured in curriculum Development.
• Objectives in the education policies may be attainable; too ambitious target setting may be avoided.
4. **List of topics you want to add in Mathematics curriculum for Class 9th.**

- Basic concept of differentiation.
- Basic concept of integration.
- Application of all concepts from daily life.
- Application of matrices.
- Vectors.
- Application of quadratic equation.

5. **List of topics you want to delete in Mathematics curriculum for Class 9th**

- Factorization of cyclic order.
- HCF, LCM by division method.
- Theoretical Portion like Geometrical theorems be minimized.
- Logarithm
- Exercises of theorems.
### GRADATION OF THE UNITS OF MATHEMATICS BOOK

#### Table 77: Item wise percentage of Unit No.1

<table>
<thead>
<tr>
<th>S.No</th>
<th>Feature</th>
<th>Excellent %age</th>
<th>Very Good %age</th>
<th>Good %age</th>
<th>Undecided %age</th>
<th>Insufficient %age</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Subject matter of the unit</td>
<td>23.75%</td>
<td>5%</td>
<td>71.25%</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>2</td>
<td>Sequence of the topics in the unit</td>
<td>21.25%</td>
<td>13.75%</td>
<td>53.75%</td>
<td>11.25%</td>
<td>x</td>
</tr>
<tr>
<td>3</td>
<td>Presentation of the subject matter</td>
<td>75%</td>
<td>8.75%</td>
<td>15%</td>
<td>1.25%</td>
<td>x</td>
</tr>
<tr>
<td>4</td>
<td>Application of the concepts given in the unit</td>
<td>52.50%</td>
<td>20.0%</td>
<td>21.25%</td>
<td>6.25%</td>
<td>x</td>
</tr>
<tr>
<td>5</td>
<td>Development of logical reasoning</td>
<td>40.0%</td>
<td>20.0%</td>
<td>37.50%</td>
<td>2.50%</td>
<td>x</td>
</tr>
<tr>
<td>6</td>
<td>Development of interest in the students</td>
<td>5.0%</td>
<td>33.75%</td>
<td>41.25%</td>
<td>13.0%</td>
<td>7.0%</td>
</tr>
<tr>
<td>7</td>
<td>Examples and problems given in exercises in this unit</td>
<td>25.0%</td>
<td>52.50%</td>
<td>17.50%</td>
<td>5.0%</td>
<td>x</td>
</tr>
<tr>
<td>8</td>
<td>Level of difficulty of the unit</td>
<td>10.0%</td>
<td>15.0%</td>
<td>66.25%</td>
<td>8.75%</td>
<td>x</td>
</tr>
</tbody>
</table>

N=675
Subject matter of the unit:
Table 77 shows that majority 71.25% of the respondents opined that the subject matter of the chapter was good, 23.75% termed it excellent, and 5.0% said it was very good. Nobody gave opinion about undecided or insufficient.

Sequence of the topics in the unit
Table 77 shows that majority 53.75% of the respondents opined that the Sequence of the topics in the unit was good, 21.25% termed it excellent, 13.75% said it was very good and 11.25% as undecided whereas nobody gave opinion about its insufficiency.

Presentation of the subject matter
Table 77 shows that majority 75.0% of the respondents opined that the Presentation of the subject matter was excellent, 15.0% termed it good, 8.75% said it was very good and 1.25% as undecided whereas nobody gave opinion about its insufficiency.

Application of the concepts given in the unit
Table 77 shows that majority 52.50% of the respondents opined that Application of the concepts given in the unit was excellent, 21.25% termed it good, 20.0% said it was very good and 6.25% as undecided whereas nobody gave opinion about its insufficiency.

Development of logical reasoning
Table 77 shows that majority 40.0% of the respondents opined that Development of logical reasoning was excellent, 37.50% termed it good, 20.0% said it was very good and 2.50% as undecided whereas nobody gave opinion about its insufficiency.
Development of interest in the students

Table 77 shows that majority 41.25% of the respondents opined that Development of interest in the students was good, 5.0% termed it excellent, and 33.75% said it was very good and 13.0% as undecided whereas nobody gave opinion about its insufficiency.

Examples and problems given in exercises in this unit

Table 77 shows that majority 52.50% of the respondents opined that Examples and problems given in exercises in this unit was very good, 25.0% termed it excellent, 17.50% said it was good and 5.0% as undecided whereas nobody gave opinion about its insufficiency.

Level of difficulty of the unit

Table 77 shows that majority 66.25% of the respondents opined that the level of difficulty of the unit was good, 15.0% termed it very good, 10.0% said it was excellent and 8.75% as undecided whereas nobody gave opinion about its insufficiency.
Table 78: Item wise percentage of Unit No. 2

<table>
<thead>
<tr>
<th>S.No</th>
<th>Feature</th>
<th>Excellent %age</th>
<th>Very Good %age</th>
<th>Good %age</th>
<th>Undecided %age</th>
<th>Insufficient %age</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Subject matter of the unit</td>
<td>50.0%</td>
<td>16.25%</td>
<td>15.0%</td>
<td>11.25%</td>
<td>7.50%</td>
</tr>
<tr>
<td>2</td>
<td>Sequence of the topics in the unit</td>
<td>25.75%</td>
<td>45.25%</td>
<td>15.0%</td>
<td>9.0%</td>
<td>5.0%</td>
</tr>
<tr>
<td>3</td>
<td>Presentation of the subject matter</td>
<td>1.25%%</td>
<td>8.75%</td>
<td>70.75%</td>
<td>1.25%</td>
<td>x</td>
</tr>
<tr>
<td>4</td>
<td>Application of the concepts given in the unit</td>
<td>52.50%</td>
<td>20.0%</td>
<td>21.25%</td>
<td>6.25%</td>
<td>x</td>
</tr>
<tr>
<td>5</td>
<td>Development of logical reasoning</td>
<td>17.25%</td>
<td>43.0%</td>
<td>14.25%</td>
<td>13.50%</td>
<td>11.0%</td>
</tr>
<tr>
<td>6</td>
<td>Development of interest in the students</td>
<td>11.25%</td>
<td>18.75%</td>
<td>62.0%</td>
<td>6.0%</td>
<td>2.0%</td>
</tr>
<tr>
<td>7</td>
<td>Examples and problems given in exercises in this unit</td>
<td>13.0%</td>
<td>25.0%</td>
<td>31.25%</td>
<td>17.25%</td>
<td>13.50%</td>
</tr>
<tr>
<td>8</td>
<td>Level of difficulty of the unit</td>
<td>26.25%</td>
<td>52.0%</td>
<td>13.25%</td>
<td>6.50%</td>
<td>2.0%</td>
</tr>
</tbody>
</table>

N=675
Subject matter of the unit:
Table 78 shows that majority 50.0% of the respondents opined that the subject matter of the chapter was excellent, 16.25% termed it very good, 15.0% said it was good, 11.25% gave opinion about it as undecided, and 7.50% as insufficient.

Sequence of the topics in the unit
Table 78 shows that majority 45.25% of the respondents opined that the sequence of the topics in the unit was very good, 25.75% termed it excellent, 15.0% said it was good and 9.0% as undecided whereas 5.0% gave opinion about its insufficiency.

Presentation of the subject matter
Table 78 shows that majority 70.75% of the respondents opined that the presentation of the subject matter was good, 1.25% termed it excellent, 8.75% said it was very good and 1.25% as undecided whereas nobody gave opinion about its insufficiency.

Application of the concepts given in the unit
Table 78 shows that majority (52.50 %) of the respondents opined that the Application of the concepts given in the unit was excellent, 21.25% termed it good, 20.0% said it was very good and 6.25% as undecided whereas nobody gave opinion about its insufficiency.

Development of logical reasoning
Table 78 shows that majority (43.0%) of the respondents opined that the Development of logical reasoning was very good, 17.25% termed it excellent, 14.25% said it was good and 13.50% as undecided whereas 11.0% gave opinion about its insufficiency.

Development of interest in the students
Table 78 shows that majority 62.0% of the respondents opined that the Development of interest in the students was good, 11.25% termed it excellent, and 18.75% said it was
very good and 6.0% as undecided whereas only 2.0% gave opinion about its insufficiency.

**Examples and problems given in exercises in this unit**

Table 78 shows that majority 31.25 of the respondents opined that the examples and problems given in exercises in this unit was good, 25.0% termed it very good, 17.25% said it is undecided, 13.5% as insufficient whereas 13.0% gave opinion about its excellence.

**Level of difficulty of the unit**

Table 78 shows that majority (52.0%) of the respondents opined that the level of difficulty of the unit was good, 26.25% termed it excellent, 13.25% said it was good, 6.50% as undecided whereas only 2.0% gave opinion about its insufficiency.
Table 79. Item wise percentage of Unit No.3

<table>
<thead>
<tr>
<th>S.No</th>
<th>Feature</th>
<th>Excellent %age</th>
<th>Very Good %age</th>
<th>Good %age</th>
<th>Undecided %age</th>
<th>Insufficient %age</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Subject matter of the unit</td>
<td>35%</td>
<td>13.75%</td>
<td>48.25%</td>
<td>3.0%</td>
<td>x</td>
</tr>
<tr>
<td>2</td>
<td>Sequence of the topics in the unit</td>
<td>29.5%</td>
<td>52.5%</td>
<td>13.75%</td>
<td>4.5%</td>
<td>x</td>
</tr>
<tr>
<td>3</td>
<td>Presentation of the subject matter</td>
<td>31.0%</td>
<td>42.0%</td>
<td>17.5%</td>
<td>9.5%</td>
<td>x</td>
</tr>
<tr>
<td>4</td>
<td>Application of the concepts given in the unit</td>
<td>4.50%</td>
<td>57.0%</td>
<td>14.25%</td>
<td>15.5%</td>
<td>18.75%</td>
</tr>
<tr>
<td>5</td>
<td>Development of logical reasoning</td>
<td>7.5%</td>
<td>71.0%</td>
<td>19.50%</td>
<td>2.0%</td>
<td>x</td>
</tr>
<tr>
<td>6</td>
<td>Development of interest in the students</td>
<td>61.25%</td>
<td>27.0%</td>
<td>11.75%</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>7</td>
<td>Examples and problems given in exercises in this unit</td>
<td>62.0%</td>
<td>31.25%</td>
<td>7.75%</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>8</td>
<td>Level of difficulty of the unit</td>
<td>12.75%</td>
<td>54.25%</td>
<td>23.25%</td>
<td>9.75%</td>
<td>x</td>
</tr>
</tbody>
</table>

N=675
Subject matter of the unit:

Table 79 shows that majority 48.25% of the respondents opined that the subject matter of the chapter was good, 35.0% termed it excellent, and 13.750% said it is very good. 3.0% as undecided, and nobody said it is insufficient.

Sequence of the topics in the unit

Table 79 shows that majority 52.50% of the respondents opined that the Sequence of the topics in the unit was very good, 29.50% termed it excellent, 13.75% said it was good and 4.50% as undecided whereas nobody gave opinion about its insufficiency.

Presentation of the subject matter

Table 79 shows that majority 42.0% of the respondents opined that the Presentation of the subject matter was very good, 31.0% termed it excellent, 17.50% said it was good and 9.50% as undecided whereas nobody gave opinion about its insufficiency.

Application of the concepts given in the unit

Table 79 shows that majority (57.00%) of the respondents opined that the Application of the concepts given in the unit was very good, 18.75% termed insufficient, 15.50% said it was undecided and 14.25% as good whereas 4.50% gave opinion about its excellence.

Development of logical reasoning

Table 79 shows that majority 71.0% of the respondents opined that the Development of logical reasoning was very good, 19.50% termed it good, 7.50% said it was excellent and 2.00% as undecided whereas nobody gave opinion about its insufficiency.

Development of interest in the students

Table 79 shows that majority 61.25% of the respondents opined that the Development of interest in the students was excellent, 27.0% termed it very good, and11.75% said it was good whereas nobody gave opinion about undecided and insufficient.
Examples and problems given in exercises in this unit

Table 79 shows that majority 62.0% of the respondents opined that the examples and problems given in exercises in this unit was excellent, 31.25% termed it very good, 7.75% said it was good, whereas nobody gave opinion about it as undecided and insufficient.

Level of difficulty of the unit

Table 79 shows that majority 54.25% of the respondents opined that the level of difficulty of the unit was very good, 23.25% termed it very good, 12.75% said it was excellent and 9.75% as undecided whereas nobody gave opinion about its insufficiency.

Table 80: Item wise percentage of Unit No.4

<table>
<thead>
<tr>
<th>S.No</th>
<th>Feature</th>
<th>Excellent %age</th>
<th>Very Good %age</th>
<th>Good %age</th>
<th>Undecided %age</th>
<th>Insufficient %age</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Subject matter of the unit</td>
<td>9.5%</td>
<td>53.0%</td>
<td>15.0%</td>
<td>12.5%</td>
<td>10.0%</td>
</tr>
<tr>
<td>2</td>
<td>Sequence of the topics in the unit</td>
<td>13.0%</td>
<td>23.25%</td>
<td>47.75%</td>
<td>9.0%</td>
<td>7.0%</td>
</tr>
<tr>
<td>3</td>
<td>Presentation of the subject matter</td>
<td>21.75%</td>
<td>61.0.0%</td>
<td>11.25%</td>
<td>6.0%</td>
<td>x</td>
</tr>
<tr>
<td>4</td>
<td>Application of the concepts given in the unit</td>
<td>13.75%</td>
<td>18.25%</td>
<td>54.75%</td>
<td>10.25%</td>
<td>4.0%</td>
</tr>
<tr>
<td>5</td>
<td>Development of logical reasoning</td>
<td>14.25%</td>
<td>41.25%</td>
<td>35.75%</td>
<td>7.25%</td>
<td>2.25%</td>
</tr>
<tr>
<td>6</td>
<td>Development of interest in the students</td>
<td>7.25%</td>
<td>15.25%</td>
<td>58.0%</td>
<td>9.50%</td>
<td>10.0%</td>
</tr>
<tr>
<td>7</td>
<td>Examples and problems given in exercises in this unit</td>
<td>11.75%</td>
<td>13.25%</td>
<td>64.0%</td>
<td>7.50%</td>
<td>3.50%</td>
</tr>
<tr>
<td>8</td>
<td>Level of difficulty of the unit</td>
<td>4.25%</td>
<td>22.25%</td>
<td>71.0%</td>
<td>2.50%</td>
<td>x</td>
</tr>
</tbody>
</table>

N=675
Subject matter of the unit:

Table 80 shows that majority 53.0% of the respondents opined that the subject matter of the chapter was very good, 12.50% termed it undecided, and 15.0% said it was very good. 9.5.0% gave opinion about it as excellent, and 10.0% said it is insufficient.

Sequence of the topics in the unit

Table 80 shows that majority 47.75% of the respondents opined that the Sequence of the topics in the unit was good, 23.25% termed it very good, 13.00% said it was excellent, 9.0% as undecided whereas 7.0% gave opinion about its insufficiency.

Presentation of the subject matter

Table 80 shows that majority 61.0% of the respondents opined that the Presentation of the subject matter was very good, 21.75% termed it excellent, 11.25% said it was good and 6.0% as undecided whereas nobody gave opinion about its insufficiency.
Application of the concepts given in the unit

Table 80 shows that majority 54.75% of the respondents opined that the application of the concepts given in the unit was good, 18.25% termed it as very good, 13.75% said it was excellent, 10.25% as undecided whereas 4.0.% gave opinion about its insufficiency.

Development of logical reasoning

Table 80 shows that majority 41.25% of the respondents opined that the development of logical reasoning was very good, 35.75% termed it good, 14.25% said it was excellent and 7.25% as undecided whereas 2.25% gave opinion about its insufficiency.

Development of interest in the students

Table 80 shows that majority 58.0% of the respondents opined that the development of interest in the students was good, 15.25% termed it as very good, and 7.25% said it was excellent 10.0% gave opinion about it as undecided and none said it is insufficient.

Examples and problems given in exercises in this unit

Table 80 shows that majority 64.0% of the respondents opined that the examples and problems given in exercises in this unit was good, 13.25% termed it very good, 11.75% said it is excellent, 7.25% gave opinion about it as undecided and 3.50% about its insufficiency.

Level of difficulty of the unit

Table 80 shows that majority 71.0% of the respondents opined that the level of difficulty of the unit was good, 22.25% termed it as very good, 4.25% said it was excellent and 2.50% as undecided whereas nobody gave opinion about its insufficiency.
Table 81: Item wise percentage of Unit No.5

<table>
<thead>
<tr>
<th>S.No</th>
<th>Feature</th>
<th>Excellent %age</th>
<th>Very Good %age</th>
<th>Good %age</th>
<th>Undecided %age</th>
<th>Insufficient %age</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Subject matter of the unit</td>
<td>10.50%</td>
<td>9.25%</td>
<td>50.50%</td>
<td>16.75%</td>
<td>13.0%</td>
</tr>
<tr>
<td>2</td>
<td>Sequence of the topics in the unit</td>
<td>2.0%</td>
<td>20.75%</td>
<td>48.25%</td>
<td>9.25%</td>
<td>19.75%</td>
</tr>
<tr>
<td>3</td>
<td>Presentation of the subject matter</td>
<td>11.0%</td>
<td>20.25%</td>
<td>45.25%</td>
<td>3.50%</td>
<td>20.0%</td>
</tr>
<tr>
<td>4</td>
<td>Application of the concepts given in the unit</td>
<td>8.0%</td>
<td>17.25%</td>
<td>39.75%</td>
<td>8.25%</td>
<td>26.75%</td>
</tr>
<tr>
<td>5</td>
<td>Development of logical reasoning</td>
<td>13.75%</td>
<td>20.25%</td>
<td>47.50%</td>
<td>7.50%</td>
<td>11.0%</td>
</tr>
<tr>
<td>6</td>
<td>Development of interest in the students</td>
<td>6.25%</td>
<td>18.25%</td>
<td>51.0%</td>
<td>2.50%</td>
<td>22.0%</td>
</tr>
<tr>
<td>7</td>
<td>Examples and problems given in exercises in this unit</td>
<td>2.25%</td>
<td>11.75%</td>
<td>58.0%</td>
<td>9.0%</td>
<td>19.0%</td>
</tr>
<tr>
<td>8</td>
<td>Level of difficulty of the unit</td>
<td>13.25%</td>
<td>19.75%</td>
<td>30.75%</td>
<td>11.25%</td>
<td>25.0%</td>
</tr>
</tbody>
</table>

N=675
Subject matter of the unit:

Table 81 shows that majority 50.50% of the respondents opined that the subject matter of the chapter was good, 16.75% termed it as undecided, and 13.0% said it was insufficient. 10.50% gave opinion about it as excellent, and 9.25% said it was very good.

Sequence of the topics in the unit

Table 81 shows that majority 48.25% of the respondents opined that the sequence of the topics in the unit was good, 20.75% termed it very good, 19.75% said it was insufficient, 9.25% as undecided whereas 2.0% gave opinion about its excellence.

Presentation of the subject matter

Table 81 shows that majority 45.25% of the respondents opined that the presentation of the subject matter was good, 20.25% termed it as very good, 20.0% said it was insufficient, 11.0% as excellent whereas 3.50% gave opinion about it as undecided.

Application of the concepts given in the unit

Table 81 shows that majority 39.75% of the respondents opined that the application of the concepts given in the unit was good, 26.75% termed it insufficient, 17.25% said it was very good, 8.25% as undecided whereas 8.0.% gave opinion about its excellence.

Development of logical reasoning

Table 81 shows that majority 47.50% of the respondents opined that the development of logical reasoning was good, 20.25% termed it very good, 13.75% said it is excellent and 11.0% as insufficient whereas 7.50% gave opinion about it as undecided.
**Development of interest in the students**

Table 81 shows that majority 51.0% of the respondents opined that the development of interest in the students was good, 18.25% termed it as very good, and 6.25% said it was excellent 2.50% gave opinion about undecided and 22.0 said it was insufficient.

**Examples and problems given in exercises in this unit**

Table 81 shows that majority 58.0% of the respondents opined that the examples and problems given in exercises in this unit was good, 11.75% termed it as very good, 2.25% said it was excellent, 9.0% as undecided and 19.0% about its insufficiency.

**Level of difficulty of the unit**

Table 81 shows that majority 30.75% of the respondents opined that the level of difficulty of the unit was good, 19.75% termed it very good, 13.25% said it was excellent and 11.25% as undecided whereas 25.0 % gave opinion about its insufficiency.

**Table 82: Item wise percentage of Unit No. 6**

<table>
<thead>
<tr>
<th>S.No</th>
<th>Feature</th>
<th>Excellent %age</th>
<th>Very Good %age</th>
<th>Good %age</th>
<th>Undecided %age</th>
<th>Insufficient %age</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Subject matter of the unit</td>
<td>3.50%</td>
<td>11.25%</td>
<td>72.0%</td>
<td>x</td>
<td>13.25%</td>
</tr>
<tr>
<td>2</td>
<td>Sequence of the topics in the unit</td>
<td>6.25%</td>
<td>67.25%</td>
<td>20.50%</td>
<td>6.0%</td>
<td>x</td>
</tr>
<tr>
<td>3</td>
<td>Presentation of the subject matter</td>
<td>15.50%</td>
<td>73.25%</td>
<td>11.00%</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>4</td>
<td>Application of the concepts given in the unit</td>
<td>7.25%</td>
<td>23.50%</td>
<td>48.25%</td>
<td>x</td>
<td>21.0%</td>
</tr>
<tr>
<td>5</td>
<td>Development of logical reasoning</td>
<td>3.25%</td>
<td>65.0%</td>
<td>23.50%</td>
<td>x</td>
<td>8.25%</td>
</tr>
<tr>
<td>6</td>
<td>Development of interest in the students</td>
<td>11.75%</td>
<td>78.0%</td>
<td>10.25%</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>7</td>
<td>Examples and problems given in exercises in this unit</td>
<td>13.25%</td>
<td>19.75%</td>
<td>30.75%</td>
<td>11.25%</td>
<td>25.0%</td>
</tr>
<tr>
<td>8</td>
<td>Level of difficulty of the unit</td>
<td>5.50%</td>
<td>77.0%</td>
<td>17.50%</td>
<td>x</td>
<td>x</td>
</tr>
</tbody>
</table>

N=675
Subject matter of the unit:

Table 82 shows that majority 72.0% of the respondents opined that the subject matter of the chapter was good, and 13.25% said it was insufficient. 3.50% as excellent, and 11.25% said it was very good whereas nobody marked it as undecided.

Sequence of the topics in the unit

Table 82 shows that majority 67.25% of the respondents opined that the sequence of the topics in the unit was very good, 20.50% termed it good, 6.25% as excellent whereas 6.0% gave opinion about its insufficiency.

Presentation of the subject matter

Table 82 shows that majority 73.25% of the respondents opined that the presentation of the subject matter was very good, 11.0% termed it good, 15.50% as excellent whereas nobody said it is insufficient or undecided.
Application of the concepts given in the unit

Table 82 shows that majority 48.25% of the respondents opined that the application of the concepts given in the unit was good, 23.50% termed it was very good, 21.0% said it was insufficient, 7.25% as excellent whereas nobody gave opinion about it as undecided.

Development of logical reasoning

Table 82 shows that majority 65.0% of the respondents opined that the development of logical reasoning was very good, 23.50% termed it good, 8.25% said it was insufficient and 3.25% as excellent whereas 7.50% gave opinion about it as undecided.

Development of interest in the students

Table 82 shows that majority 78.0% of the respondents opined that the development of interest in the students was very good, 11.75% termed it excellent, and 10.25% said it was good, whereas nobody gave opinion about it as undecided and insufficient.

Examples and problems given in exercises in this unit

Table 82 shows that majority 30.75% of the respondents opined that the examples and problems given in exercises in this unit was good, 19.75% termed it very good, 13.25% said it is excellent, 11.25% gave opinion about it as undecided and 25.0% about insufficiency.

Level of difficulty of the unit

Table 82 shows that majority 77.0% of the respondents opined that the level of difficulty of the unit was good, 17.50% termed it good, 5.50% said it was excellent and nobody gave opinion about it as undecided and insufficient.
Table 83: Item wise percentage of Unit No.7

<table>
<thead>
<tr>
<th>S.No</th>
<th>Feature</th>
<th>Excellent %age</th>
<th>Very Good %age</th>
<th>Good %age</th>
<th>Undecided %age</th>
<th>Insufficient %age</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Subject matter of the unit</td>
<td>11.75%</td>
<td>20.25%</td>
<td>46.25%</td>
<td>3.50%</td>
<td>18.25%</td>
</tr>
<tr>
<td>2</td>
<td>Sequence of the topics in the unit</td>
<td>8.00%</td>
<td>30.25%</td>
<td>49.00%</td>
<td>10.50%</td>
<td>7.75%</td>
</tr>
<tr>
<td>3</td>
<td>Presentation of the subject matter</td>
<td>6.25%</td>
<td>29.50%</td>
<td>51.00%</td>
<td>3.25%</td>
<td>10.0%</td>
</tr>
<tr>
<td>4</td>
<td>Application of the concepts given in the unit</td>
<td>3.75%</td>
<td>13.25%</td>
<td>45.00%</td>
<td>17.50%</td>
<td>20.50%</td>
</tr>
<tr>
<td>5</td>
<td>Development of logical reasoning</td>
<td>2.25%</td>
<td>19.50%</td>
<td>61.75%</td>
<td>7.50%</td>
<td>9.00%</td>
</tr>
<tr>
<td>6</td>
<td>Development of interest in the students</td>
<td>5.00%</td>
<td>11.25%</td>
<td>56.75%</td>
<td>9.50%</td>
<td>17.50%</td>
</tr>
<tr>
<td>7</td>
<td>Examples and problems given in exercises in this unit</td>
<td>2.75%</td>
<td>21.25%</td>
<td>45.25%</td>
<td>11.25%</td>
<td>19.50%</td>
</tr>
<tr>
<td>8</td>
<td>Level of difficulty of the unit</td>
<td>4.50%</td>
<td>9.75%</td>
<td>54.25%</td>
<td>14.00%</td>
<td>17.5%</td>
</tr>
</tbody>
</table>

N=675
Subject matter of the unit:
Table 83 shows that majority 46.25% of the respondents opined that the subject matter of the chapter was good, 20.25% termed it very good, 18.25% said it was insufficient, 11.75% gave opinion about it as excellent, and 3.50% said it was undecided.

Sequence of the topics in the unit
Table 83 shows that majority 49.00% of the respondents opined that the sequence of the topics in the unit was good, 30.25% termed it very good, 7.75% said it was insufficient, 10.50% as undecided whereas 8.00% gave opinion about its excellence.

Presentation of the subject matter
Table 83 shows that majority 51.00% of the respondents opined that the presentation of the subject matter was good, 29.50% termed it very good, 10.0% said it was insufficient, 6.25% as excellent whereas 3.25% gave opinion about it as undecided.

Application of the concepts given in the unit
Table 83 shows that majority 45.00% of the respondents opined that the application of the concepts given in the unit was good, 20.50% termed it insufficient, 17.50% said it was undecided, 13.25% as very good whereas 3.75.% gave opinion about its excellence.

Development of logical reasoning
Table 83 shows that majority 61.75% of the respondents opined that the development of logical reasoning was good, 19.50% termed it very good, 2.25% said it was excellent and 9.00% as insufficient whereas 7.50% gave opinion about it as undecided.

Development of interest in the students
Table 83 shows that majority 56.75% of the respondents opined that the Development of interest in the students was good, 11.25% termed it very good, and 5.00% said it was excellent, 9.50% gave opinion about it as undecided and 17.50% as insufficient.
Examples and problems given in exercises in this unit

Table 83 shows that majority 45.25% of the respondents opined that the examples and problems given in exercises in this unit was good, 21.25% termed it very good, 2.75% said it was excellent, 11.25% gave opinion about it as undecided and 19.50% about its insufficiency.

Level of difficulty of the unit

Table 83 shows that majority 54.25% of the respondents opined that the level of difficulty of the unit was good, 9.75% termed it very good, 4.50% said it was excellent and 14.00% as undecided whereas 17.50 % gave opinion about its insufficiency.
<table>
<thead>
<tr>
<th>S.No</th>
<th>Feature</th>
<th>Excellent %age</th>
<th>Very Good %age</th>
<th>Good %age</th>
<th>Undecided %age</th>
<th>Insufficient %age</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Subject matter of the unit</td>
<td>3.75%</td>
<td>13.00%</td>
<td>48.25%</td>
<td>7.25%</td>
<td>17.75%</td>
</tr>
<tr>
<td>2</td>
<td>Sequence of the topics in the unit</td>
<td>1.25%</td>
<td>16.50%</td>
<td>49.00%</td>
<td>10.25%</td>
<td>23.00%</td>
</tr>
<tr>
<td>3</td>
<td>Presentation of the subject matter</td>
<td>2.00%</td>
<td>21.00%</td>
<td>55.25%</td>
<td>12.50%</td>
<td>9.25%</td>
</tr>
<tr>
<td>4</td>
<td>Application of the concepts given in the unit</td>
<td>3.25%</td>
<td>65.5%</td>
<td>17.75%</td>
<td>6.00%</td>
<td>7.50%</td>
</tr>
<tr>
<td>5</td>
<td>Development of logical reasoning</td>
<td>11.75%</td>
<td>12.50%</td>
<td>63.50%</td>
<td>13.50%</td>
<td>x</td>
</tr>
<tr>
<td>6</td>
<td>Development of interest in the students</td>
<td>9.25%</td>
<td>7.75%</td>
<td>70.0%</td>
<td>6.75%</td>
<td>6.25%</td>
</tr>
<tr>
<td>7</td>
<td>Examples and problems given in exercises in this unit</td>
<td>8.50%</td>
<td>21.00%</td>
<td>51.75%</td>
<td>4.50%</td>
<td>14.25%</td>
</tr>
<tr>
<td>8</td>
<td>Level of difficulty of the unit</td>
<td>3.50%</td>
<td>24.5%</td>
<td>42.00%</td>
<td>8.25%</td>
<td>21.75%</td>
</tr>
</tbody>
</table>

N=675
Subject matter of the unit:

Table 84 shows that majority 48.25% of the respondents opined that the subject matter of the chapter was good, 13.00% termed it very good, 17.75% said it was insufficient, 3.75% gave opinion about it as excellent, and 7.25% said it is undecided.

Sequence of the topics in the unit

Table 84 shows that majority 49.00% of the respondents opined that the sequence of the topics in the unit was good, 16.50% termed it very good, 23.0% said it was insufficient, 10.25% as undecided whereas 1.25% gave opinion about its excellence.

Presentation of the subject matter

Table 84 shows that majority (55.25%) of the respondents opined that the presentation of the subject matter was good, 21.0% termed it very good, 9.25% said it was insufficient, 2.0% as excellent whereas 12.50% gave opinion about it as undecided.

Application of the concepts given in the unit

Table 84 shows that majority 65.50% of the respondents opined that the application of the concepts given in the unit was very good, 17.75% termed it good, 6.00% said it was undecided, 7.50% as insufficient whereas 3.25.% gave opinion about its excellence.

Development of logical reasoning

Table 84 shows that majority 63.50% of the respondents opined that the development of logical reasoning was good, 12.50% termed it very good, 11.75% said it is excellent, 13.50% gave opinion about its indecisiveness whereas nobody said it was insufficient.
Development of interest in the students

Table 84 shows that majority 70.0% of the respondents opined that the development of interest in the students was good, 7.75% termed it very good, and 9.25% said it was excellent, 6.75% gave opinion about undecided and 6.25% said it was insufficient.

Examples and problems given in exercises in this unit

Table 84 shows that majority 51.75% of the respondents opined that the examples and problems given in exercises in this unit was good, 21.00% termed it very good, 8.50% said it was excellent, 4.50% as undecided and 14.25% about its insufficiency.

Level of difficulty of the unit

Table 84 shows that majority 42.00% of the respondents opined that the level of difficulty of the unit was good, 24.50% termed it very good, 3.50% said it was excellent and 8.25% as undecided whereas 21.75 % gave opinion about its insufficiency.

Table 85: Item wise percentage of Unit No. 9

<table>
<thead>
<tr>
<th>S.No</th>
<th>Feature</th>
<th>Excellent %age</th>
<th>Very Good %age</th>
<th>Good %age</th>
<th>Undecided %age</th>
<th>Insufficient %age</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Subject matter of the unit</td>
<td>17.0%</td>
<td>71.0%</td>
<td>7.0%</td>
<td>3.50%</td>
<td>1.50%</td>
</tr>
<tr>
<td>2</td>
<td>Sequence of the topics in the unit</td>
<td>11.25%</td>
<td>13.25%</td>
<td>73.5%</td>
<td>2.00%</td>
<td>x</td>
</tr>
<tr>
<td>3</td>
<td>Presentation of the subject matter</td>
<td>17.25%</td>
<td>65.50%</td>
<td>9.5%</td>
<td>4.5%</td>
<td>3.25%</td>
</tr>
<tr>
<td>4</td>
<td>Application of the concepts given in the unit</td>
<td>9.50%</td>
<td>78.0%</td>
<td>10.5%</td>
<td>2.50%</td>
<td>x</td>
</tr>
<tr>
<td>5</td>
<td>Development of logical reasoning</td>
<td>14.5%</td>
<td>24.50%</td>
<td>54.5%</td>
<td>3.50%</td>
<td>3.00%</td>
</tr>
<tr>
<td>6</td>
<td>Development of interest in the students</td>
<td>13.5%</td>
<td>69.0%</td>
<td>16.0%</td>
<td>1.50%</td>
<td>x</td>
</tr>
<tr>
<td>7</td>
<td>Examples and problems given in exercises in this unit</td>
<td>18.5%</td>
<td>73.5%</td>
<td>18.0%</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>8</td>
<td>Level of difficulty of the unit</td>
<td>11.0%</td>
<td>10.5%</td>
<td>76.5%</td>
<td>2.5%</td>
<td>x</td>
</tr>
</tbody>
</table>

N=675
Subject matter of the unit:

Table 85 shows that majority 71.0\% of the respondents opined that the subject matter of the chapter was very good, 7.0\% termed it good, 1.50\% said it was insufficient, 17.0\% gave opinion about it as excellent, and 3.50\% said it was undecided.

Sequence of the topics in the unit

Table 85 shows that majority 73.5\% of the respondents opined that the sequence of the topics in the unit was good, 13.25\% termed it as very good, 2.00\% as undecided whereas 11.25\% gave opinion about its excellence.

Presentation of the subject matter

Table 85 shows that majority 65.50\% of the respondents opined that the presentation of the subject matter was very good, 9.50\% termed it good, 3.25\% said it was insufficient, 17.25\% as excellent whereas 4.50\% gave opinion about it as undecided.
**Application of the concepts given in the unit**

Table 85 shows that majority 78.00% of the respondents opined that the application of the concepts given in the unit was very good, 10.50% said it was good, 2.50% as undecided whereas 9.50% gave opinion about its excellence.

**Development of logical reasoning**

Table 85 shows that majority 54.5% of the respondents opined that the development of logical reasoning in this unit was good, 24.50% termed it very good, 14.5% said it was excellent and 3.00% as insufficient whereas 3.50% gave opinion about it as undecided.

**Development of interest in the students**

Table 85 shows that majority 69.0% of the respondents opined that the development of interest in the students was very good, 16.0% termed it good, and 13.5% said it was excellent, 1.50% gave opinion about it as undecided and nobody said it was insufficient.

**Examples and problems given in exercises in this unit**

Table 85 shows that majority 73.5% of the respondents opined that the examples and problems given in exercises in this unit was very good, 18.0% termed it good, 18.5% said it was excellent, whereas nobody said it was undecided and insufficient.

**Level of difficulty of the unit**

Table 85 shows that majority 76.5% of the respondents opined that the level of difficulty of the unit was good, 10.5% termed it very good, 11.0% said it was excellent and 2.5% as undecided whereas nobody gave opinion about its insufficiency.
ANALYSIS OF INTERVIEW WITH EXPERTS

1) Almost all the experts (100%) opined that they were satisfied with the objectives of Mathematics given by Curriculum Wing, Ministry of Education, Islamabad.

2) Majority of the experts (67.0%) held the viewpoint that out of nine objectives of Mathematics given by Curriculum Wing, Ministry of Education, Islamabad, four objectives were not being achieved. Firstly: the application of concepts of Mathematics in everyday life. Secondly: to enhance the ability of reasoning consistently among students. Thirdly: the habit of examining any situation analytically and critically. Fourthly: the spirit of exploration and discovery.

3) As far as the effectiveness and coherence of objectives with those of developed countries is concerned, majority of the experts (59.0%) were of the view that these objectives are at par with the objectives of Mathematics in developed countries in theoretical context. According to experts these objectives are not being fully practically achieved.

4) Majority (63.0%) of the experts opined to focus upon:
   
   - To give due importance to application of Mathematical concepts in practical form in daily routine life.
   - To enhance creativity and logical thinking among students.
   - To enable students to examine any situation critically and analytically
   - To develop the spirit of exploration and discovery among students
   - To give students market oriented Mathematical education.
5) Most of the experts (68.0%) were not satisfied with the criteria of content selection. They gave following reasons:

- It is not based on our philosophy of life
- Lack of focus on logical reasoning and scientific thinking
- Major focus is on cramming and rote learning
- It is not market and job oriented

6) Most of the experts (55.0%) were not satisfied with the criteria of organization of content. They gave following reasons:

- Sequence is not appropriate
- Continuity between topics is not proper
- Lack of integration at different class levels; mathematics curriculum is excessively repetitive in different class levels
- Lack of examples
- Examples are not taken from daily real life and these examples are not related with daily real life
- Lack of activities suggested in book

7) Experts gave following suggestions regarding improvement of existing teaching methods of Mathematics:

- The teacher has to play the role of facilitator in teaching and students must be encouraged to participate in different activities
- Only lecture method is widely used, it may be replaced with modern techniques

- The activity based curriculum may be mostly used

8) The majority (71.0%) of experts pointed out that activities given in the book are not linked with curriculum objectives so these may be changed or improved in the manner that these should have sound linkage with the objectives.

9) Majority (69.0%) of the experts suggested following techniques for the improvement of evaluation:

- Evaluation may be fully based on the accomplishment of all objectives

- Paper questions may not be taken from prescribed text book, rather these should be unseen for students

- Major portion of the paper may be objective type

- Selection of test items may be done in such a way that it should focus:
  
  a) Complete syllabus
  
  b) Discourage rote learning
  
  c) Minimizing selective study
  
  d) Maximizing in depth knowledge
  
  e) Covering higher order cognitive skills

10) Majority (81.0%) of experts suggested following weaknesses in Mathematics curriculum:

- Mathematics curriculum is not sufficiently demanding.

- Lack of examples and the existing examples are not taken from daily life
• Not discouraging cramming and selective study
• It is not related to world of work (not market oriented)
• Lack of activities
• No proper integration at different class levels and lack of continuity in concepts
• Not making students logical thinkers and creative learners

11) For the improvement of existing curriculum of mathematics at secondary level following suggestions were offered:
  • Enhancing relation of Mathematics with scientific world
  • Fostering elements of mathematical vision among students because teachers tend to "state" ideas rather than to "develop" them.
  • Making students independent and creative learners
  • Multi text books may be introduced
  • More and more activities may be included
  • Variety of examples from real life may be given

12) The following suggestions were given for the inculcation of problem solving skills and logical reasoning among the students:
  • Introducing multi text books
  • Excessive activity based curriculum
  • Much involvement of students in class and teacher’s role be minimized to only a guide/ facilitator
  • Projects and assignments
DISCUSSION

Every citizen of present modern world examines and manifold manifestations of mathematics all around him. If we overview the modern life, there is no aspect of man’s life today which has not been influenced by mathematics in one way or the other. This is because we live in an age of scientific culture which owes a lot to mathematics. There has been, in recent times, rapid addition of knowledge in realm of mathematical science. As a result teaching of mathematics has become an inevitable ingredient of education system of any country. Rather we can say that mathematics has become alpha and omega as well as part and parcel of human life without which we cannot live comfortably.

Mathematics has earned an important status emerging as a powerful force for socio-economic changes and development of the nation. It deals with identifying problems, searching explanations and seeking solutions for the welfare and advancement of the society. Therefore, it becomes imperative to direct the youth towards mathematics education. Courses may be designed in such a way that every pupil should be given an opportunity appropriate to the needs and potentials of individuals well as of the country. (Govt. of Pakistan, 1991).

The advancement of science and technology is entirely influenced by the research and development in the field of Mathematics being the mother of all sciences.

The objectives of Mathematics Education must be transformed to meet the critical needs of our society: an informed electorate, mathematically literate workers, opportunity for all students, and problem-solving skills that serve life long learning. Both the content that is being taught and the way it is being taught need to be reconsidered and in many cases, transformed.
Pakistan is far behind from the developed countries, especially in the field of science including Mathematics. So to cope with challenges of the new era and globalization there is a definite need to update our curricula according to the recent developments and concepts to make it in consonance with the emerging needs. Research activities in our country are mainly focused on natural sciences and agriculture. Unfortunately, Mathematic which is quiet important field is being ignored and there is dire need to put some efforts into this area of knowledge. Venkataiah (1993) is of the view that “the curriculum being the main instrument of education, it cannot be static. As the frontiers of knowledge expand with time, the curriculum may be updated, restructured in such a way that it will enhance the quality and standard of education. Thus innovations in curriculum become inevitable, with the changes that take place in the society.”

Curriculum Analysis and change has been a burning issue in Pakistan during the recent past. There is a dire need of revision of curricula in general and mathematics curriculum in special. It seems to be necessary to update and revise the curriculum to make it vibrant and responsive to the modern socio-economic, technical, professional and labour market needs of the country and comparable with international standards (Ministry of Education). Keeping in view these facts the researcher decided to undertake the Analytical study of the Mathematics Curriculum at Secondary school level in Pakistan. Study was designed to analyze the curriculum of mathematics for class 9th prescribed by the Punjab Text Book Board Lahore. The major objectives of the study were: To analyze the policy objectives of the Mathematics curriculum at secondary school level in Pakistan, to analyze Mathematics curriculum process with special reference to: Objectives, Content, Methodology, Evaluation; To critically review the subject matter of the Mathematics in order to point out the strengths and weaknesses at Secondary school
level in Pakistan; to explore the opinion of the curriculum experts about the worth of Mathematics Curriculum at secondary school level in Pakistan; to suggest measures for the improvement of secondary school Mathematics curriculum in Pakistan.

As far as the achievement of the objectives of mathematics is concerned both the experts as well as teachers were of the view that policy objectives regarding higher order cognitive abilities like creativity, logical reasoning and critical thinking are not being achieved. The study revealed that present mathematics curriculum does not enable students to reason consistently, Students cannot draw correct conclusion for given hypothesis, and present curriculum does not inculcate the habit of examining any situation critically and analytically. These findings are in agreement with the Halai (2004); SPDC Survey (2003); Werick & Reimers (1997). However it enables the students to communicate their thoughts through symbolical expression and graphs. It does not foster in students the spirit of exploration and discovery. The subject matter does not develop problem solving skills among the students. Number of solved examples is insufficient. Mathematics curriculum requires specific teaching methodology, teaching methodologies being used for secondary school mathematics curriculum were appropriate with respect to Knowledge, Scientific thinking, needs of the learner, and readiness of the learner but not appropriate with respect to problem solving skills, and logical reasoning.

The study revealed that experts opined that content selection procedure was not satisfactory because it was not based on philosophy of life, lacking of integration between the topics, lack of activities, but being direct involved with teaching the teachers said that it had lack of integration between levels. This supports Naeem *-(1994) who concluded that one chapter in book did not help in understanding next one.
Samuel (2002) found that problem solving appeared to be an effective way to teach and learn mathematics and it enriched the curriculum, content through tasks which provide a higher level of cognitive challenge to the student. His findings were further compounded by the fact that the content of existing mathematics text book lent themselves heavily to traditional methods. The findings of this research also supported his views in this regard.

Examination for Secondary school mathematics is not based upon the items which test, analysis, synthesis, evaluation the scientific process, the scientific skill, attitudes but majority of the respondents was leaning towards the agreement that Examination for Secondary school mathematics curriculum is based upon the items which test knowledge, achievement of the objectives, comprehension, application, rote learning/memorization, and contents of the course. Students are not judged in academic year by their interests, assignments and home work.

Arif et al. (1998) conducted a research on a comparative study of secondary school physics curriculum and its effectiveness since 1947 found that all chapters of physics were presented in the previous board’s paper and question paper mainly focus on testing knowledge and application. Comprehension and understanding needs to be emphasized in the question paper. This can only be done if teacher and paper setters are trained in the techniques of paper setting. Rehman (2004) found that the evaluation system in Pakistan supports cramming and rote learning then comprehension, analysis and evaluation. Munaza (2004) found that our examinations did not evaluate students in the light of objectives already formulated. She pointed out that there was lack of consistency between curriculum textbooks and examinations. In this way, the present
research also supported their findings as the researcher concluded that the examinations were mainly focused on testing the knowledge, comprehension and to some extent application. Whereas analysis, synthesis, and evaluation i.e. higher order cognitive abilities are not being tested.

While commenting on the achievement of instructional objectives given by the ministry of education curriculum wing, the majority of the respondents opined that objectives regarding unit 1 were being achieved except DeMorgan’s Law using Venn diagrams. This concept needs to be further elaborated and simplified. In Unit 2, the functions and their types need to be rewritten and described. In Unit 3, all the determined objectives are being achieved except 4th Law of Logarithm which should be clearly described with simple examples. Students are facing problems in establishing and applying the formulae $a^3+b^3$ and $a^3+b^3+c^3-3abc$. According to the opinion of majority of the respondents this is due to students’ habit of rote memorization and traditional chalk and talk teaching methods. In Unit 5, a concept of factorization through cyclic order has been criticized by the majority of the teachers and experts as well. They were of the opinion that it should not be included at this stage.

The instructional objectives of Unit 6 were mostly been achieved in the light of findings of study. Unit 7, 8 and 9 are pertaining to fundamental concepts of geometry, demonstrative and practical geometry. This study indicated that the instructional objectives regarding these units were not being achieved. Probably the reason may be that the students are generally not prepared for logical operations in the previous classes. Even the majority of teachers did not have clarity of concepts. Therefore, it was suggested that this portion of the mathematics curriculum may be revised and simplified and enriched with suitable examples from daily life. The findings of the study also support the study conducted by
NISTE (1999) which states that unfortunately any curriculum change which could mathematics teacher in trouble is usually left by them and mostly they lead newly introduced topics untouched. Most commonly left out topics at secondary school levels are (i) concept of functions and mapping (ii) exercises of theorem (iii) the practical geometry and (iv) concept of matrices.

Samuel (2002) found that problem solving appeared to be an effective way to teach and learn mathematics and it enriched the curriculum, content through tasks which provide a higher level of cognitive challenge to the student. His findings were further compounded by the fact that the content of existing mathematics text book lent themselves heavily to traditional methods. The findings of this research also supported his views in this regard.

Zahur et al. (2002) found that the present curriculum has no relevance to their life situation. The finding of this study also agrees with this finding.

In the curriculum, experts’ opinion curriculum was reported not to have proper weightage for theory and practical and components of the contents were found unable to develop habit of creativity and logical reasoning. According to the findings of the study, it emerged that only a single teaching method is being practiced in the schools i.e. lecture method. Similarly, the single textbook use is also obvious.

In the light of above discussion it is suggested that the mathematics curriculum for class 9th prescribed by the Punjab Textbook Board needs to be re-conceptualized and revised accordingly keeping in view the instructional objectives as well as policy objectives.
CHAPTER 5

SUMMARY, FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS

5.1 SUMMARY

The study was designed to analyze the National Mathematics Curriculum at secondary school level in Pakistan. The major objectives of the study were to analyze the policy objectives of the Mathematics curriculum at secondary school level in Pakistan, to analyze Mathematics curriculum process with special reference to Objectives, Content, Methodology, and Evaluation, to critically review the subject matter of the Mathematics in order to point out the strengths and weaknesses at Secondary school level in Pakistan, to explore the opinion of the curriculum experts about the worth of Mathematics Curriculum at secondary school level in Pakistan, and finally to suggest measures for the improvement of secondary school Mathematics curriculum in Pakistan.

Population for this study constituted all the experts of National Science Curriculum (Mathematics) working in the Ministry of Education Islamabad, Curriculum Bureau in Provinces and working teachers of the Mathematics at secondary school level in Pakistan. Random and convenient sampling procedures were adopted for the selection of sample. One thousand and eighty mathematics teachers from 540 schools of the nine districts of Punjab province, whereas 36 experts/educationists were also included in the sample. Questionnaire based on three point Likert’s scale was used to obtain the opinion of the working mathematics teachers and the experts were interviewed. Before administering the questionnaires it was pilot tested and revised in the light of suggestions made by the experts and data obtained.
5.2 FINDINGS

Findings on the basis of analysis of questionnaire for teachers:

1. The opinion of the majority (66.67%) of the respondents was leaning towards the agreement with the statement that “The present curriculum of mathematics enables the students to acquire understanding of mathematics concepts”.

2. The opinion of the majority (64.93%) of the respondents was towards the disagreement with the statement that “The present curriculum of mathematics enables students to apply mathematical concepts to daily life problems”.

3. The opinion of the majority (57.99%) of the respondents was leaning towards the agreement with the statement that Present curriculum provides sound basis for higher studies

4. The opinion of the majority (51.16%) of the respondents was leaning towards the disagreement with the statement that present mathematics curriculum enable students to reason consistently.

5. The opinion of the majority (62.62%) of the respondents was leaning towards the disagreement with the statement that Students can draw correct conclusion for given hypothesis.

6. The opinion of the majority (68.06%) of the respondents was leaning towards the disagreement with the statement that present curriculum inculcates the habit of examining any situation critically and analytically.

7. The opinion of the majority (53.82%) of the respondents was leaning towards the agreement with the statement that present curriculum enables the students to communicate their thoughts through symbolical expression and graphs.
8. The opinion of the majority (52.31%) of the respondents was leaning towards the agreement with the statement that present curriculum develops in students a sense of distinction between relevant and irrelevant data.

9. The opinion of the majority (54.51%) of the respondents was leaning towards the agreement with the statement that present curriculum gives the student basic understanding and awareness of power of mathematics.

10. The opinion of the majority (53.70%) of the respondents was leaning towards the disagreement with the statement that present curriculum fosters in students the spirit of exploration and discovery.

11. The opinion of the majority (59.84%) of the respondents was leaning towards the agreement with the statement that contents are according to mental level of student.

12. The opinion of the majority (52.43%) of the respondents was leaning towards the agreement with the statement that the subject matter of the book creates interest among the students.

13. The opinion of the majority (61.69%) of the respondents was leaning towards the disagreement with the statement that the subject matter produces creativity among the students.

14. The opinion of the majority (68.52%) of the respondents was leaning towards the disagreement with the statement that the subject matter develops problem solving skills among the students.

15. The opinion of the majority (57.75%) of the respondents was leaning towards the disagreement with the statement that the subject matter develops habit of logical reasoning among the students.
The opinion of the majority (61.46%) of the respondents was leaning towards the agreement with the statement that the introduction of each unit clearly highlights the contents of corresponding unit.

The opinion of the majority (52.43%) of the respondents was leaning towards the disagreement with the statement that content given in the book help in building foundation for future science and technological education”.

The opinion of the majority (58.68%) of the respondents was leaning towards the agreement with the statement that the selection of content is based upon Philosophy of life.

The opinion of the majority (51.27%) of the respondents was leaning towards the agreement with the statement that the selection of content is based upon scientific thinking.

The opinion of the majority (54.17%) of the respondents was leaning towards the agreement with the statement that the selection of content is based upon the acquisition of information from theories and principles.

The opinion of the majority (47.57%) of the respondents was leaning towards the agreement with the statement that the selection of content is based upon development of scientific attitude and interest.

The opinion of the majority (53.94%) of the respondents was leaning towards the disagreement with the statement that selection of content are based upon development of logical reasoning.

The opinion of the majority (53.82%) of the respondents was leaning towards the agreement with the statement that selection of content are based upon Update knowledge.
The opinion of the majority (56.83%) of the respondents was leaning towards the agreement with the statement that organization of content is based upon topic wise sequence.

The opinion of the majority (66.2%) of the respondents was leaning towards the agreement with the statement that organization of content is based upon simple to complex.

The opinion of the majority (61.11%) of the respondents was leaning towards the agreement with the statement that organization of content is based upon Continuity between topics.

The opinion of the majority (56.60%) of the respondents was leaning towards the disagreement with the statement that organization of content is based upon Integration between levels.

The opinion of the majority (54.05%) of the respondents was leaning towards the agreement with the statement that criteria for selection of activities are based upon curriculum objectives.

The opinion of the majority (58.1%) of the respondents was leaning towards the agreement with the statement that Criteria for selection of activities are based upon understanding of concepts.

The opinion of the majority (49.88%) of the respondents was leaning towards the agreement with the statement that Criterion for selection of activities is based upon Verification of facts.

The opinion of the majority (57.29%) of the respondents was leaning towards the agreement with the statement that Criterion for selection of activities is based upon Relevance with theory.
The opinion of the majority (58.22%) of the respondents was leaning towards the disagreement with the statement that Criteria for selection of activities is based upon strengthening of scientific and problem solving skills.

The opinion of the majority (57.29%) of the respondents was leaning towards the agreement with the statement that pictures, figures, and graphs are sufficient to explain the related topics.

The opinion of the majority (59.26%) of the respondents was leaning towards the agreement with the statement that language of text book is understandable.

The opinion of the majority (63.89%) of the respondents was leaning towards the agreement with the statement that script of book is free of errors.

The opinion of the majority (57.52%) of the respondents was leaning towards the agreement with the statement that Mathematics concepts in the book are understandable.

The opinion of the majority (55.67%) of the respondents was leaning towards the agreement with the statement that difficult concepts are clearly explained in the book.

The opinion of the majority (46.41%) of the respondents was leaning towards the disagreement with the statement that number of solved examples is sufficient.

The opinion of the majority (59.72%) of the respondents was leaning towards the agreement with the statement that list of key words is provided in the end.

The opinion of the majority (67.48%) of the respondents was leaning towards the agreement with the statement that index is provided in the end.
The opinion of the majority (53.59%) of the respondents was leaning towards the agreement with the statement that mathematics curriculum requires specific teaching methodology.

The opinion of the majority (80.44%) of the respondents was leaning towards the agreement with the statement that mathematic curriculum is based upon single text book.

The opinion of the majority of the respondents was leaning towards the agreement with the statement that inductive-deductive (55.67%), demonstration (53.70%), activity (59.49%), and problem solving (54.28%) methods are suitable for teaching mathematics but majority disagreed with lecture method (56.48%) as suitable teaching method.

The opinion of the majority of the respondents was leaning towards the agreement with the statement that teaching methodology being used for secondary school mathematics curriculum were appropriate with respect to Knowledge (59.84%), readiness of the learner (52.78%) but majority did not agree that teaching methodology being used is appropriate with respect to scientific thinking (53.31%), needs of the learner (51.16%), problem solving skills (50.35%), and logical reasoning (72.74%).

The opinion of the majority (66.90%) of the respondents was leaning towards the disagreement with the statement that demonstration models are presented to students to explain some difficult concepts.

The opinion of the majority (59.14%) of the respondents was leaning towards the agreement with the statement that home work is given to students on regular basis.
The opinion of the majority (56.25%) of the respondents was leaning towards the agreement with the statement that home work given to students is checked on regular basis.

The opinion of the majority (66.55%) of the respondents was leaning towards the disagreement with the statement that audio video aids were provided to you to teach mathematics in the class rooms.

The opinion of the majority (60.53%) of the respondents was leaning towards the agreement with the statement that students are interested in knowing the application of mathematics in daily life.

The opinion of the majority of the respondents was leaning towards the disagreement with the statement that examination for secondary school mathematics is based upon the items which test (57.06%), analysis (47.57%), synthesis (52.78%), evaluation (50.00%) the scientific process (52.43%), the scientific skill (54.86%), scientific attitudes (54.17%) but majority of the respondents was leaning towards the agreement that examination for secondary school mathematics curriculum is based upon the items which test achievement of the objectives (57.06%), knowledge (58.91%), comprehension (57.64%), application (58.10%), rote learning/ memorization (59.95%), and contents of the course (45.95%).

The opinion of the majority (52.89%) of the respondents was leaning towards the agreement with the statement that Pattern of the choice in the board’s mathematics paper is appropriate.

The opinion of the majority of the respondents was leaning towards the disagreement with the statement that students are judged in academic year by their
interests (63.89%) and assignments (60.65%) but majority of the respondents was leaning towards the agreement that Students are judged in academic year by the home work (59.14%).

The opinion of the majority (53.13%) of the respondents was leaning towards the agreement with the statement that internal system for testing mathematics curriculum is suitable in our environment.

While commenting on the achievement of instructional objectives given by the ministry of education curriculum wing the opinion of the majority of the respondents was leaning towards the agreement with the statement that students are able to write sets in set builder notation (50.46%), can verify the closure property of union and intersection (57.99%), commutative and associative property of union and intersection and distributive property of union over intersection and vice versa (61.0%), students can prove and apply De Morgan’s Laws (57.06%), The opinion of the majority of the respondents was leaning towards the agreement that students are able to verify closure property of union and intersection (56.59%), commutative and associative property of union and intersection (59.49%), by using Venn diagrams but the trend of the majority (52.20%) was towards the disagreement that the students are able to prove and apply De Morgan’s Laws using Venn diagrams.

The opinion of the majority of the respondents was leaning towards the agreement with the statement that students can define and write ordered pairs, Cartesian product, and binary relation (61.23%), but the majority did not agree that they can define and write functions and its kinds (58.10%). The opinion of the majority was in agreement that student can read and plot points in the Cartesian
plane and they know the fact that there is one-to-one correspondence between the points on the plane and the ordered pairs represented by RxR.

56 About the achievement of instructional objectives of unit 2 (System of real numbers) the opinion of the majority of the respondents was leaning towards the agreement with the statement that students can know and write properties of real numbers (59.84%), have the concept of surds and can find conjugate of surds (57.75%), can evaluate the expression of the type \( x^2 + 1/x^2 \), \( x^4 + 1/x^4 \) when \( x \) is a surd by rationalization (54.51%), know the laws of exponents of real numbers and can apply them in the simplification of expression containing them (52.55%).

57 About the achievement of instructional objectives of unit 3 (Logarithm) the opinion of the majority of the respondents was leaning towards the agreement that student can write numbers in scientific notation (55.79%), have the concept of log and anti-log and can find a logarithm of a number and find its anti-log (58.33%). Students can prove the laws of logarithms and can apply them in computation of simple and harder problems (48.96%).

58 About the achievement of instructional objectives of unit 4 (Algebraic Expressions) the opinion of the majority of the respondents was leaning towards the agreement that students can solve harder cases of division of algebraic expression (50.35%), can establish and apply the formulae \((a+b+c)^2\) (59.95%), but the majority was leaning towards disagreement that student can establish and apply the formula \(a^3+b^3\) (52.43%), \((a+b)^3\) (55.90%), \(a^3+b^3+c^3-3abc\) (55.79%)

59 About the achievement of instructional objectives of unit 5 (Factorization, HCF, LCM, Simplification, and Square root)) the opinion of the majority of the respondents was leaning towards the agreement that students can factorize the
expressions reducible to $a^2-b^2$ form, $ax^2+bx+c$, $a^3+b^3+c^3-3abc$ (46.88%) but the majority did not agree that student are able to factorize the expression in cyclic order (63.08%) and the expressions requiring the application of factor theorem (56.83%). However the majority agreed that student can find LCM and HCF of algebraic expression by factorization (60.07%), by division (61.46%), student can simplify the algebraic expressions (59.83%), and can find square root of algebraic expression by factorization (56.71%) and by division (53.59%).

About the achievement of instructional objectives of unit 6 (Matrices) the opinion of the majority of the respondents was leaning towards the agreement that students have the concept of matrices , its rows, columns and its types (60.30%), can add , subtract, and multiply the matrices ,and they know the fact that multiplication of matrices is associative but not commutative in general (51.04%), know the identities of matrices (55.32%),can distinguish between singular and non singular matrices (53.35%), and can find additive and multiplicative inverse of a matrix (if it exists) (54.62%).Students can also solve linear equation using matrices (52.20%), and by Crammer’s rule (55.47%).

About the achievement of instructional objectives of unit 7 (Fundamental Concepts of Geometry) the opinion of the majority of the respondents was leaning towards the disagreement with the statement that students know the postulates which are used in the demonstrative geometry (58.92%), have the concepts of geometrical theorems and its proof (64.70%), use deductive reasoning in proving geometrical theorems (67.71%).

About the achievement of instructional objectives of unit 8 & 9 (Demonstrative and Practical Geometry) the opinion of the majority of the respondents was
leaning towards the disagreement with the statement that students know and can apply analytic method (54.63%), synthetic method (57.99%), and reduction and absurdum method (56.94%) for proving geometrical result, however the majority of the responding teachers showed agreement towards the statement that students can construct triangles (including ambiguous case) (50.69%), can draw right bisector of sides (51.85%), the bisectors of angles (54.17%), can draw medians of the sides of triangle (49.07%) and the altitudes of the sides of triangle (48.03%).

**Findings on the basis of the analysis of interview with experts**

1) Almost all the experts (100%) opined that they were satisfied with the objectives of Mathematics given by Curriculum Wing, Ministry of Education, Islamabad.

2) Majority of the experts (67.0%) held the view point that out of nine objectives of Mathematics given by Curriculum Wing, Ministry of Education, Islamabad, four objectives were not being achieved. Firstly: the application of concepts of Mathematics in everyday life. Secondly: the ability of logical reasoning consistently among students. Thirdly: the habit of examining any situation analytically and critically. Fourthly: the spirit of exploration and discovery.

3) As far as the effectiveness and coherence of objectives with developed countries is concerned, majority of the experts (59.0%) were of the view that these objectives are at par with the objectives of Mathematics in developed countries in theoretical context. According to experts these objectives are not being fully practically achieved.

4) Majority (63.0%) of the experts opined to focus upon:
- Give due importance to application of Mathematical concepts in practical form in daily routine life.

- Enhance creativity and logical thinking among students.

- Enable students to examine any situation critically and analytically

- Develop the spirit of exploration and discovery among students

- Give students market oriented Mathematical education.

5) Most of the experts (68.0%) were not satisfied with the criteria of content selection. They gave following reasons:

- It is not based on our philosophy of life

- Lack of focus on logical reasoning and scientific thinking

- Major focus is on cramming and rote learning

- It is not market and job oriented

6) Most of the experts (55.0%) were not satisfied with the criteria of organization of content. They gave following reasons:

- Sequence is not appropriate

- Continuity between topics is not proper

- Lack of integration at different class levels, mathematics curriculum is excessively repetitive in different class levels

- Lack of examples

200
Examples are not taken from daily real life and these examples are not related with daily real life

Lack of activities suggested in book

7) Experts gave following suggestions regarding improvement of existing teaching methods of Mathematics:

- The teacher should play the role of facilitator in teaching and students must be encouraged to participate in different activities
- Only lecture method is widely used, it may be replaced with modern techniques
- The activity based curriculum may be used

8) The majority (71.0%) of experts pointed out that the activities are not linked with curriculum objectives so these may be changed or improved in the manner that these should have sound linkage with the objectives.

9) Majority (69.0%) of the experts suggested following techniques for the improvements of evaluation process:

- Evaluation may be fully based on the accomplishment of all objectives
- Paper questions may not be taken from prescribed text book, rather these should be unseen for students
- Major portion of the paper may be objective type
- Selection of test items may be done in such a way that it should focus:
  a) Full syllabus
b) Discourage rote learning

c) Minimize selective study

d) Maximize in depth knowledge

e) Cover higher order cognitive skills

10) Majority (81.0%) of experts suggested following weaknesses in Mathematics curriculum:

- Mathematics curriculum is not sufficiently demanding.
- Lack of examples and the existing examples are not taken from daily life
- Not discouraging cramming and selective study
- It is not related to world of work (not market oriented)
- Lack of activities
- No proper integration at different class levels and lack of continuity in concepts
- Not making students logical thinkers and creative learners

11) For the improvement of existing curriculum of mathematics at secondary school level following suggestions were offered:

- Enhancing relation of Mathematics with scientific world
- Fostering elements of mathematical vision among students
- Making students independent and creative learners
- Multi text books culture may be introduced
- More and more activities may be included
- Variety of examples from real life may be given
12) The following suggestions were given for the inculcation of problem solving skills and logical reasoning among the students:

- Introducing multi text books
- Excessive activity based curriculum
- Much involvement of students in class and teacher’s role be minimized to only a guide/ facilitator
- Projects and assignments should be assigned to students according to their mental level

5.3 CONCLUSIONS

Conclusions on the basis of teachers’ responses:

On the basis of the findings of as the result of the responses of teachers, the researcher reached on the following conclusions.

1. The present curriculum of mathematics enables the students to acquire understanding of mathematics concepts, enables them to apply these concepts in daily life problems, to communicate their thoughts through symbolical expressions and graphs, provides sound basis for higher studies but it does not enable the students to reason consistently, and does not inculcate in them the habit of examining any situation critically and analytically. It also does not foster in students the spirit of exploration and discovery

2. That present curriculum gives the student basic understanding and awareness of power of mathematics and develops in students a sense of distinction between relevant and irrelevant data but they cannot draw correct conclusion for given hypothesis
3. Contents of the mathematics book are according to mental level of student and introduction of each unit clearly highlights the contents of corresponding unit. It creates interest among the students but does not produce creativity, problem solving skills, and logical reasoning among the students.


5. Selection of content are based upon philosophy of life, scientific thinking, acquisition of information from theories and principles, development of attitude, interest, and update knowledge but selection of content are not based upon development of logical reasoning among the students

6. Organization of content is based upon topic wise sequence, simple to complex, Continuity between topics but is not based upon integration between levels.

7. Criteria for selection of activities are based upon curriculum objectives, understanding of concepts, verification of facts, relevance with theory, but it is not based upon strengthening of scientific attitude and problem solving skills.

8. Pictures, figures, and graphs are sufficient to explain the related topics


10. Mathematics concepts in the book are understandable and the difficult concepts are clearly explained in the book. Index and the list of key words is provided at the end of the book but the number of solved examples is insufficient.

11. Mathematic curriculum is based upon single text book and it requires specific teaching methodology. Also Inductive-deductive, demonstration, activity, and problem solving methods are suitable for teaching mathematics but majority disagreed with lecture method as suitable teaching method.
12. Teaching methodologies being used for secondary school mathematics curriculum were appropriate with respect to knowledge, readiness of the learner but majority did not agree that teaching methodology being used is appropriate with respect to scientific thinking problem solving skills, and logical reasoning.

13. The students are interested in knowing the application of mathematics in daily life but models and other A.V. Aids are not available to explain some difficult concepts.

14. Home work is given to students and also checked on regular basis.

15. Examination for Secondary school mathematics is not based upon the items which test, analysis, synthesis, evaluation the scientific process, the scientific skill, scientific attitudes but the examination for Secondary school mathematics curriculum is based upon the items which test achievement of the objectives, knowledge, comprehension, application, rote learning/memorization.

16. Pattern of the choice in the board’s mathematics paper is appropriate.

17. Students are not judged in academic year by their interests and assignments but they are judged in academic year by the home work.

18. Internal system for testing mathematics curriculum is suitable in our environment.

19. Students are able to write sets in set builder notation, can verify the closure property of union and intersection, commutative and associative property of union and intersection and distributive property of union over intersection and vice versa, students can prove and apply De Morgan’s Laws, similarly they are able to verify closure property of union and intersection, commutative and associative property of union and intersection, by using Venn diagrams but they are unable to prove and apply De Morgan’s Laws using Venn diagrams.
20. Students can define and write ordered pairs, Cartesian product, and binary relation but they cannot define and write functions and its kinds. However the student can read and plot points in the Cartesian plane and they know the fact that there is one-to-one correspondence between the points on the plane and the ordered pairs represented by RxR.

21. Students can know and write properties of real numbers, have the concept of surds and can find conjugate of surds, can evaluate the expression of the type $x^2 + 1/x^2$, $x^4 + 1/x^4$ when $x$ is a surd by rationalization, know the laws of exponents of real numbers and can apply them in the simplification of expression containing them.

22. Students can write numbers in scientific notation, and find its anti log. Students can prove the laws of logarithms, have the concept of log and anti log and can find a logarithm of a number and can apply them in computation of simple and harder problems.

23. Students can solve harder cases of division of algebraic expression, can establish and apply the formulae $(a+b+c)^2$, but the majority was leaning towards disagreement that student can establish and apply the formula $a^3+b^3$, $(a+b)^3$, $a^3+b^3+c^3-3abc$.

24. Students are unable to factorize the expressions reducible to $a^2-b^2$ form, $ax^2+bx+c$, $a^3+b^3+c^3-3abc$ but they are unable to factorize the expression in cyclic order and the expressions requiring the factor theorem. However they can find LCM and HCF of algebraic expression by factorization, by division, student can simplify the algebraic expressions, and can find square root of algebraic expression by factorization and by division.
25. Students have the concept of matrices, its rows, columns and its types, can add, subtract, and multiply the matrices, and they know the fact that multiplication of matrices is associative but not commutative in general, they also know the identities of matrices, can distinguish between singular and non-singular matrices, and can find additive and multiplicative inverse of a matrix (if it exists). Students can also solve linear equations using matrices, and by Cramer’s rule.

26. Students do not know the postulates which are used in the demonstrative geometry, do not have the concepts of geometrical theorems and its proof, and cannot use deductive reasoning in proving geometrical theorems.

27. Students neither know nor can apply analytic method, synthetic method, and reduction and absurdum method for proving geometrical result; however they can construct triangles (including ambiguous case), can right bisector of sides, the bisectors of angles, and can draw medians of the sides of triangle and the altitudes of the sides of triangle.

**Conclusions on the basis of interview with experts**

On the basis of interview with experts, the researcher reached on the following conclusions.

1) It was concluded that all the experts opined that they were satisfied with the objectives of Mathematics given by Curriculum Wing, Ministry of Education, Islamabad. However, majority of the experts held the view point that out of nine objectives of Mathematics given by Curriculum Wing, Ministry of Education, Islamabad, four objectives were not being achieved. Firstly: the application of concepts of Mathematics in everyday life. Secondly: to enhance the ability of reasoning consistently among students. Thirdly: the habit of examining any
situation analytically and critically. Fourthly: the spirit of exploration and discovery.

2) Majority of the experts opined to focus upon giving due importance to application of Mathematical concepts in practical form in daily routine life, enhancing creativity and logical thinking among students, enabling students to examine any situation critically and analytically, developing the spirit of exploration and discovery among students, and giving students market oriented Mathematical education.

3) Most of the experts were not satisfied with the criteria of content selection. Because according to them, it is not based on our philosophy of life, it have lack of focus on logical reasoning and scientific thinking as its major focus is on cramming and rote learning and it is not market and job oriented.

4) The researcher concluded that most of the experts were not satisfied with the criteria of organization of content. They gave reasons as sequence is not appropriate, continuity between topics is not proper, lack of integration at different class levels; mathematics curriculum is excessively repetitive in different class levels, lack of examples, examples are not taken from daily real life and these examples are not related with daily real life and lack of activities suggested in book.

5) As far as the suggestions regarding improvement of existing teaching methods of Mathematics were concerned, the experts suggested that the teacher has to play the role of facilitator in teaching and students must be encouraged to participate in
different activities, only lecture method is widely used, it may be replaced with modern techniques and the activity based curriculum may be introduced.

6) It was concluded that the experts were in favour of improving evaluation techniques regarding evaluation of students as evaluation may be fully based on the accomplishment of all objectives, paper questions may not be taken from prescribed text book, rather these should be unseen for students, major portion of the paper may be objective type and selection of test items may be done in such a way that it should focus on full syllabus, vanishing rote learning, minimizing selective study, maximizing in depth knowledge and coverage over higher order cognitive skills.

7) The researcher concluded that main weaknesses in mathematics curriculum as suggested by the experts were that Mathematics curriculum is not sufficiently demanding, lack of examples and the existing examples are not taken from daily life, mathematics curriculum was not discouraging cramming and selective study, it is not related to world of work (not market oriented) Lack of activities, no proper integration at different class levels and lack of continuity in concepts and it is not making students logical thinkers and creative learners.
5.4 RECOMMENDATIONS

1. Teachers are not consulted in curriculum development process. It is recommended that representatives of teachers may be involved in the curriculum development process by making their committees.

2. Content of the secondary school mathematics curriculum was found unable to develop habit of logical reasoning and problem solving skills among the students. It is therefore, recommended that content of mathematics curriculum may be updated accordingly in order to achieve the objectives. Moreover, Subject matter may be enriched so that it may create interest, creativity and scientific attitudes.

3. Sufficient audio-visual aids were not available to teachers to teach mathematics. These may be provided to teachers in order to make teaching learning process more attractive for the students.

4. Internal cum external system of evaluation be introduced and some reasonable weightage of total marks may be allocated for practical mathematical work and projects throughout the academic year.

5. The prevailing examination system encourages rote learning and failed to measure higher order skills. Hence, it is recommended that examination may contain qualitative approach rather than only quantitative approach i.e. focus may be on learning rather than marks orientation.

6. The maximum chapters on the whole are good but the students are very week in the area of Geometry. They are unable to prove theorems as a result their ability of logical reasoning is not good. Therefore geometrical portions may be rationalized and simplified.
7. Single author books may be replaced with multi author books i.e. concept of one book be changed by the multi books.

8. Similar study may be conducted for analysis of Mathematics curriculum of intermediate level.

9. Comparative studies of Pakistani secondary school and British GCES- O level physics, chemistry and Biology curricula have been conducted but that of mathematics curriculum has not been taken up. Future researchers may carry out such kind of comparative study.
ABBIBLIOGRAPHY


Government of Pakistan, (1968), National Curriculum in Mathematics, Islamabad: Ministry of Education.


**QUESTIONNAIRE FOR SECONDARY SCHOOL MATHEMATICS TEACHERS**

**PART -1: PERSONAL INFORMATION**

1. Name (optional) ____________________________________________________________

2. Qualification  
   a) Academic _____________________________________________
   b) Professional ___________________________________________

3. Experience (In Years)  
   a) Teaching_____________________________________________
   b) Curriculum Planning & Development _______________________
   c) Total ________________________________________________

4. Name of the organization / Institution _______________________________________

5. Location: Rural/ Urban  

6. Gender: Male/ Female

7. Telephone No. Office ___________ Residences / Mobile_________________

8. Email add: ________________________________

Please give your responses to the following items and Mark (✓) the columns you consider as the most appropriate.

**PART- 2: TEACHING OBJECTIVES OF MATHEMATICS**

The objectives of teaching Mathematics to 9th and 10th classes as indicated by Curriculum Wing, Ministry of Education, in National Curriculum 2000 are given below. Choose appropriate option regarding their achievement.

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Items</th>
<th>A</th>
<th>UD</th>
<th>DA</th>
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<tbody>
<tr>
<td>1.</td>
<td>Enable students to acquire understanding of concepts of Mathematics</td>
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<td>2.</td>
<td>Enable students to apply the concepts of mathematics to the problems of world they live in.</td>
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<td>3.</td>
<td>Provide the students with sound basis for specialization in mathematics at higher stages or apply it in scientific and technical fields</td>
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<td>4.</td>
<td>Enable the students to reason consistently</td>
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</table>
5. Draw correct conclusion for given hypothesis
6. Inculcate in them the habit of examining any situation critically and analytically
7. Enable the students to communicate their thoughts through symbolic expressions and graphs
8. Develop sense of distinction between relevant and irrelevant data
9. Give the students basic understanding and awareness of the power of mathematics in generalization and abstraction
10. Foster in students the spirit of exploration and discovery

### PART-3: CONTENT, SUBJECT MATTER AND TEXT BOOK

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Items</th>
<th>A</th>
<th>UD</th>
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<tbody>
<tr>
<td>1.</td>
<td>The content of the course are according to the mental level of the students</td>
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<td>2.</td>
<td>The subject matter of the book creates interest among the students.</td>
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<td>3.</td>
<td>The subject matter of the book produces creativity among the students</td>
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<td>4.</td>
<td>The subject matter of the book develops problem solving skills among the students</td>
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<td>5.</td>
<td>The subject matter of the book develops habit of logical reasoning among the students</td>
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<td>6.</td>
<td>The introduction of each chapter clearly highlights the contents of corresponding units</td>
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<td>7.</td>
<td>Contents given in the book help in building foundations for future science and technological education</td>
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<td>8.</td>
<td>The selection of the content for secondary school mathematics curriculum is based upon the:</td>
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<tr>
<td></td>
<td>- Philosophy of life</td>
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<td></td>
<td>- Scientific thinking</td>
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<td></td>
<td>- The acquisition of information’s from theories and principles</td>
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<td></td>
<td>- The development of attitudes, interests &amp; logical reasoning</td>
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<td></td>
<td>- Update knowledge</td>
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<td>9.</td>
<td>Figures, Graphs &amp; Pictures are sufficient to explain the related topics</td>
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<td>10.</td>
<td>The organization of content for secondary school mathematics curriculum is based upon:</td>
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<td></td>
<td>- Topic wise sequence</td>
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<td>- Simple to complex</td>
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<td>- Continuity between the topics</td>
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<td></td>
<td>- Integration between the levels</td>
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<td>11.</td>
<td>The criteria for selection of activities for secondary school mathematics curriculum is based upon the:</td>
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<tr>
<td></td>
<td>- Curriculum objectives</td>
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<td></td>
<td>- Understanding of concepts</td>
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<td></td>
<td>- Verification of facts</td>
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</table>
- Relevance with theory
- Strengthening of scientific and problem solving skills

12 The language of the textbook is understandable

13 The script of the book is free of errors

14 Mathematics concepts given in the textbook are understandable

15 Difficult concepts are clearly explained in the book where required

16 Numbers of the solved examples are sufficient in the prescribed textbook

17 A list of the key words is provided at the end of the book

18 The index is provided at the end of the book

**PART-4: TEACHING METHODOLOGY**

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Items</th>
<th>A</th>
<th>UD</th>
<th>D</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>The mathematics curriculum requires/demands the specific teaching methodology</td>
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<tr>
<td>2</td>
<td>Mathematics curriculum is based upon single textbook</td>
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<td>3</td>
<td>Teaching method you think, the most suitable to teach mathematics</td>
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<td></td>
<td>• Inductive-deductive method</td>
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<td></td>
<td>• Lecture method</td>
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<td></td>
<td>• Demonstration method</td>
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<td></td>
<td>• Activity method</td>
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<td></td>
<td>• Problem solving method</td>
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<tr>
<td>4</td>
<td>The teaching methodologies being used for secondary school mathematics curriculum are appropriate with respect to</td>
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<td></td>
<td>• Knowledge</td>
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<td>• Scientific thinking</td>
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<td></td>
<td>• Problem solving skills</td>
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<td></td>
<td>• Logical reasoning</td>
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<td></td>
<td>• Needs of the learners</td>
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<td>• Readiness of the learner</td>
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<td>5</td>
<td>Demonstration models are presented to the students to explain some difficult concepts</td>
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<td>6</td>
<td>Homework is given to students on regular basis</td>
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<tr>
<td>7</td>
<td>Homework given to students is checked on regular basis</td>
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<td>8</td>
<td>Audio video aids are provided to you to teach mathematics in the classroom</td>
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<tr>
<td>9</td>
<td>Students are interested in knowing the application of mathematics in daily life</td>
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### PART-5: EVALUATION

<table>
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<tr>
<th>S. No</th>
<th>Items</th>
<th>A</th>
<th>UD</th>
<th>D</th>
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<tbody>
<tr>
<td>1.</td>
<td>The examination for secondary school mathematics curriculum is based upon the items which test:</td>
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<tr>
<td></td>
<td>• Achievement of the objectives of the curriculum</td>
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<td></td>
<td>• Knowledge</td>
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<td>• Comprehension</td>
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<td>• Application</td>
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<td>• Analysis</td>
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<td>• Synthesis</td>
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<td>• Evaluation</td>
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<td>• The scientific process</td>
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<td>• The scientific skills</td>
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<td>• Attitudes</td>
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<td></td>
<td>• Rote learning / memorization</td>
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<td></td>
<td>• Contents of the course</td>
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<tr>
<td>2.</td>
<td>The pattern of choice in the Board’s Maths paper is appropriate</td>
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<td>3.</td>
<td>Students is judged in academic year by a variety of evaluation pattern, such as</td>
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<td>• Student interests</td>
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<td>• Homework</td>
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<td>• Assignments</td>
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<tr>
<td>4</td>
<td>Internal system for testing mathematics curriculum is suitable in our environment</td>
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</tbody>
</table>

### PART.6: INSTRUCTIONAL OBJECTIVES (EXPECTED OUTCOMES FOR CLASS 9th):

**Please rate the appropriate column regarding the achievement of these outcomes**

**UNIT 1: SETS**

<table>
<thead>
<tr>
<th>S. No</th>
<th>Items</th>
<th>A</th>
<th>UD</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Students are able to write a set in the set builder notation.</td>
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<td>2.</td>
<td>Can verify the property of operations on set.</td>
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<tr>
<td></td>
<td>• Closure property of union and intersection.</td>
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<tr>
<td></td>
<td>• Commutative and associative properties of union and intersection, distributive property of union over intersection and vice versa.</td>
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<tr>
<td></td>
<td>• De Morgan’s Laws.</td>
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<tr>
<td>3.</td>
<td>Can verify the above-mentioned properties using Venn diagram.</td>
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<td>4.</td>
<td>Can define and write ordered pairs, Cartesian product, binary relation and function and its kinds (into onto, one-to-one and bijective)</td>
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<td>5.</td>
<td>Can Read and plot the points in the Cartesian plane and know the fact that there is a one-to-one correspondence between the points on the plane and the ordered pairs represented by RxR.</td>
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</tbody>
</table>
### UNIT 2: SYSTEM OF REAL NUMBER

1. Can know and write properties of real numbers
2. Have the concept of a surd and find the conjugate of surd:
3. Can evaluate the expressions of the types $x^2 + 1/x^2$, $x^4 + 1/x^4$, when $x$ is a surd by rationalization.
4. Know the laws of exponents of real numbers and apply them in the simplification of the expressions containing them.

### UNIT 3: LOGARITHMS

1. Can write numbers in scientific notation.
2. Have the concepts of log and antilog, write the characteristic and mantissa of logarithms of a number and find its antilog.
3. Can prove the laws of logarithms and apply them in computation of simple and harder problems.

### UNIT 4: ALGEBRAIC EXPRESSIONS

1. Can solve harder cases of division of algebraic expressions
2. Can establish and apply the following formulas
   - $(a+b+c)^2 = a^2 + b^2 + c^2 + 2ab + 2bc + 2ca$
   - $(a+b)^3 = a^3 + b^3 + 3ab(a+b)$
   - $(a+b)(a^2+ab+b^2) = a^3 + b^3$
   - $(a+b+c)(a^2+b^2+c^2-ab-bc-ca) = a^3 + b^3 + c^3 - 3abc$

### UNIT 5: FACTORIZATION, HCF, LCM, SIMPLIFICATION AND SQUARE ROOT

1. Factorize the following types of expressions.
   - Expressions reducible to $a^2 - b^2$ form $ax^2 + bx + c$, $a^3 + b^3$, $a^3 + b^3 + c^3 - 3abc$.
   - Expressions in cyclic order
   - Expressions requiring the applications of factor theorem
2. Find the H.C.F and L.C.M of algebraic expressions by factorization and by division.
3. Simplify the algebraic expressions.
4. Find the square roots of algebraic expressions by factorization and by division.

### UNIT 6: MATRICES

1. Learn the concepts of a matrix, its row, columns, order and type of matrices.
2. Add, subtract and multiply matrices, know that the multiplication of matrices is associative but not commutative in general.
3. Know the additive and multiplicative identities of matrices
4. Distinguish between singular and non-singular matrices.
5. Find the additive inverse and the multiplicative inverse of a matrix (if exists).
6. Can solve two linear equations using matrices and applying Cramer’s rule.
UNIT 7: FUNDAMENTAL CONCEPTS OF GEOMETRY

1. Know the postulates, which are used in the study of demonstrative geometry.
2. Have the concept of a geometrical theorem and its proof.
3. Use deductive reasoning in proving geometrical theorems effectively.

UNIT 8, 9: DEMONSTRATIVE GEOMETRY, PRACTICAL GEOMETRY

<p>| | |</p>
<table>
<thead>
<tr>
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<tbody>
<tr>
<td>1.</td>
<td>Know and apply analytic, synthetic and reduction ad absurdum methods of proving geometrical results (theorems, corollaries and riders).</td>
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<tr>
<td>2.</td>
<td>Prove the theorems and apply them in proving their riders.</td>
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<tr>
<td>3.</td>
<td>Construct triangles (including ambiguous case).</td>
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<td></td>
<td>• Can draw right bisectors of sides.</td>
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<td></td>
<td>• The Bisectors of angles.</td>
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<td></td>
<td>• The medians and the altitudes of a triangle.</td>
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</tbody>
</table>

PART-7: OPEN QUESTIONS

a. What are the major drawbacks in the existing secondary school mathematics curriculum for class 9th?

b. In your opinion what are the difficult areas in existing secondary school mathematics curriculum for class 9th students?

c. Suggestions to overcome above mentioned difficulties

d. List of topics you want to add in mathematics curriculum for class 9th.

e. List of topics you want to delete from mathematics curriculum for class 9th.
PART -8: GRADATION OF THE UNITS

Grade different features of the units of the prescribed curriculum of mathematics for class 9th by writing the appropriate letter A, B, C, D, E in their corresponding column.

The grades are as described below:
A=Excellent,  B=Very Good,  C=Good,  D=Undecided,  E=Insufficient

The units of the prescribed textbook of mathematics for class 9th are as under.
Unit 1: Sets,       Unit 2: System of Real       Unit 3: Logarithms,
Unit 4: Algebraic   Unit 5: Factorizations,       Unit 6: Matrices,
Expressions        HCF, LCM, Simplification      and Square Root,
and Square Root,
Unit 7: Fundamental Geometry,       Unit 8: Demonstrative Geometry,
concepts of Geometry

<table>
<thead>
<tr>
<th>S.No</th>
<th>Features</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Subject matter of the units</td>
<td>1 2 3</td>
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<tr>
<td>2</td>
<td>Sequence of topic in the units</td>
<td>4 5</td>
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<tr>
<td>3</td>
<td>Presentation of the subject matter</td>
<td>6 7</td>
</tr>
<tr>
<td>4</td>
<td>Application of the concepts given in the units</td>
<td>8 9</td>
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<tr>
<td>5</td>
<td>Development of the logical reasoning in the student</td>
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<td>6</td>
<td>Development of the interest in the student</td>
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<tr>
<td>7</td>
<td>Examples and Problems given in exercises in the units</td>
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<tr>
<td>8</td>
<td>Level of difficulty of the units</td>
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</tbody>
</table>
INTERVIEW SCHEDULE
FOR EXPERTS/EDUCATIONISTS

3. Name (optional) _________________________________________________________

4. Qualification  
   a) Academic __________________________________________________________
   b) Professional ________________________________________________________

3. Experience (in years)  
   a) Teaching __________________________________________________________
   b) Curriculum Planning & Development ____________________________
   c) Total _____________________________________________________________

4. Name of the organization / Institution _________________________________

Q.1. Are you satisfied with the objectives of mathematics as given by ministry of Education?
   Ans. ___________________________________________________________________

Q.2. Are the objectives of teaching mathematics at secondary school level as given by ministry of education being achieved?
   Ans. ___________________________________________________________________

Q.3. Do you think that the objectives of Mathematics are at par with the most developed countries.

Q.4. If you were the authority to make or revise the objectives, on what objectives you would focus?
   Ans. ___________________________________________________________________

Q.5. Are you satisfied with the criteria of selection of mathematics content? If not, give reasons why?
Q6. Are you satisfied with the criteria of organization of mathematics content? If not, give your expert opinion.

Ans. 

Q7. In your opinion, are the existing methodologies regarding teaching of Maths appropriate? If not give suggestions for improvement of existing teaching methods:

Ans. 

Q8. What criteria would you like to suggest for the selection of activities?

Ans. 

Q9. In your opinion, what techniques of evaluation should be used for judging different intellectual skills of maths students?

Ans. 

Q10. Being an expert, what major weaknesses do you see in the existing mathematics’ curriculum?

Ans. 

Q11. What measures do you suggest for the improvement of existing Maths curriculum?

Ans. 
LIST OF EXPERTS/EDUCATIONISTS

1) Dr. Muhammad Munir Kayani, Assistant Professor, Department of Education, International Islamic University, Islamabad.

2) Dr. Samina Yasmin, Assistant Professor, Department of Education, International Islamic University, Islamabad.

3) Dr. Nabi Bux Jummani, Assistant Professor, Faculty of Education, AIOU, Islamabad.

4) Dr. Muhammad Ajmal, Lecturer, Faculty of Education, AIOU, Islamabad.

5) Dr. Shafqat Ali Khan, Assistant Professor, University of Education, Lahore, Attock Campus

6) Dr. Shahid Kaleem Siddiqui, Professor, Lahore School of Economics, Lahore

7) Dr. Zaigham Qadeer, Deputy Director, FDE, Ministry of Education, Islamabad.

8) Mr. Abdul Rasheed, Assistant Educational Advisor, Ministry of Education, Islamabad.

9) Dr. Mah-i-Laqa Rafiq, Assistant Educational Advisor, Ministry of Education, Islamabad.

10) Dr. Tayyab Alam Bukhari, Head Department of Research and Development, FUCLAS, Rawalpindi.

11) Dr. Rafaqat Ali Akbar, Associate Professor, IER, Punjab University Lahore.

12) Dr. Rehamt Elahi, head Department of Mathematics, IIU, Islamabad.

13) Dr. Sawar Kamran, President Pakistan Mathematical Society, Islamabad.

14) Dr. Muhammad Yousuf, Assistant Professor, Quaid-e- Azam University, Islamabad.
15) Dr. Irshad Hussain Baluch, Associate Professor, Department of Education, Islamia University Bahawalpur.

16) Dr. Sohail Sarwar, Deputy Director, Punjab Text Book Board, Lahore.

17) Muhammad Anwar, Research Associate, Deputy Director, Punjab Text Book Board, Lahore.

18) Abdul Rauf Zahid, Text Book Editor (Science), Deputy Director, Punjab Text Book Board, Lahore.

19) Mazhar Hayat, Deputy Director, Punjab Text Book Board, Lahore.

20) Muhammad Faheem, Deputy Director, Punjab Text Book Board, Lahore.

21) Mr. Sajid Mehmmod, Senior Subject Specialist (Mathematics), Government Higher Secondary School Bhagwal (Chakwal)

22) Mr. Mehmood ul Hassan Nadeem, Director Research, FBISE, Islamabad.

23) Mr. Rao Zulfiqar Hussain, Research Officer, BISE, Faisalabad.

24) Mr. Atif Ali Khan, Research Officer, BISE, Sargodha.

25) Mr. Zaheer ud Din, Research Officer, BISE, Gujranwala.
The instructional objectives or the expected outcomes for the students of class IX as stated in the curriculum document issued by the curriculum wing of ministry of education, govt. of Pakistan are as following:

The students are expected to be able to:

1. Write a set in the set builder notation

2. Verify the following properties of operations on sets.
   
   I. Closure property of union and intersection

   II. Commutative and associative properties of union and intersection, distributive property of union over intersection and vice versa

   III. De Morgan’s Laws

3. Verify the properties mentioned in (II, III) using the Venn diagrams;

4. Define and write ordered paris, Cartesian product, binary relation and function and its kinds (into onto, (1-1) onto).

5. Read and plot the points in the Cartesian plane and know the fact that there is a one-to-one correspondence between the points on the plane and the ordered pairs represented by RxR;

6. Know and write the properties of real numbers;
7. Have the concept of a surd and find the conjugate of a surd;

8. Evaluate the expressions of the types $X^2 + 1/X^2$, $X^4 + 1/X^4$, when $X$ is a surd by rationalization.

9. Know the laws of exponents of real numbers and apply them in the simplification of the expressions containing them;

10. Write numbers in scientific notation;

11. Have the concepts of log and antilog, write the characteristic and mantissa of logarithms of a number and find its antilog.

12. Prove the laws of logarithms and apply them in computation of simple and harder problems.

13. Solve harder cases of division of algebraic expressions;

14. Establish and apply the following formulas;

   I. $(a+b+c)^2 = a^2 + b^2 + c^2 + 2ab + 2bc + 2ca,$

   II. $(a \pm b)^3 = a^3 \pm b^3 + 3ab (a \pm b)$

   III. $(a + b) (a^2 + ab + b^2) = a^3 + b^3$

   IV. $(a + b + c) (a^2 + b^2 + c^2 – ab – bc – ca) = a^3 + b^3 + c^3 – 3abc.$

15. Factorise the following types of expressions;

   I. Expressions reducible to $a^2 – b^2$ form $ax^2 + bx + c$, $a^3 + b^3 + c^3 – 3abc$,

   II. Expressions in cyclic order and.

   III. Expressions requiring the application of factor theorem.
16. Find the H.C.F and L.C.M of algebraic expressions by factorization and by division;

17. Simplify the algebraic expressions;

18. Find the square roots of algebraic expressions by factorization and by division;

19. Learn the concepts of a matrix its rows, columns, order and types of matrices.

20. Add, subtract and multiply matrices, know that the multiplication of matrices is associative but nor commutative in general.

21. Know the additive and multiplication identities of matrices.

22. Distinguish between singular and non-singular matrices.

23. Find the additive inverse and the multiplicative inverse of a matrix (if exists).

24. Solve two linear equations using matrices and applying Cramer’s rule;

25. Know the postulates which are used in the study of demonstrative geometry;

26. Have the concept of a geometrical theorem and its proof;

27. Use deductive reasoning in proving geometrical theorems effectively.

28. Know and apply analytic, synthetic and reduction ad absurdum methods of proving geometrical results (theorems, corollaries and riders).

29. Prove the theorems and apply them in proving their riders;

30. Construct triangles (including ambiguous case). Draw right bisectors of sides, the bisectors of angles, the medians and the altitudes of a triangle. (Govt. of Pakistan, 2002)