DEVELOPMENT OF A MODULE TO ENHANCE THE PERFORMANCE IN TEACHING MATHEMATICS AMONG PROSPECTIVE TEACHERS AT PRIMARY LEVEL

Thesis

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By

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2018

DECLARATION

I, SAHEEDALI M., do hereby declare that this thesis entitled as "**DEVELOPMENT OF A MODULE TO ENHANCE THE PERFORMANCE IN TEACHING MATHEMATICS AMONG PROSPECTIVE TEACHERS AT PRIMARY LEVEL"** is a genuine record of the research work done by me under the supervision of **Dr. K. VIJAYAKUMARI**, Associate Professor, Farook Training College; and that no part of the thesis has been presented earlier for the award of any Degree, Diploma or Associateship in any other University.

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The thesis is revised as per the modifications and recommendations reported by the adjudicators and resubmitted. Soft copy attached is the same as that of the resubmitted revised copy.

Farook Training College,
.06.2019.

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Farook College,

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The progress and prosperity of a country depends upon the quality of its citizens. The critical measure of the quality of citizens is the quality of education provided to them which is directly related to teacher quality. Teacher quality, in turn is depending on the quality of the teacher education that they receive through the pre-service and in-service training.

The National Policy on Education (NPE, 1986) has commented that *The status of the teacher reflects the socio-cultural ethos of the society. It is said that no people can rise above the level of its teachers.* Such exhortations are indeed an expression of the important role played by the teacher as transmitter, inspirer and promoter of eternal quest for knowledge.

The National Curriculum Framework (NCF, 2005) places different demands and expectations on the teacher, which need to be addressed both by initial and continuing teacher education. According to Right to Education Act (2010) Quality Education is Pupil's Right. To ensure quality of learner achievement, teachers with competence, professional sensitivity and motivation are highly needed.

It is common knowledge too that the academic and professional standards of teachers constitute a critical component of the essential learning conditions for achieving the educational goals. The length of academic preparation, the level and quality of subject matter knowledge and the acquisition of pedagogical skills help the teachers to meet the needs of diverse learning situations. The degree of commitment to the profession and the sensitivity to contemporary issues influence the quality of curriculum transaction in the classrooms and thereby pupil learning.

During the period of pre-service and in-service teacher education, one comes across variety of experiences related to the core and related subjects. Learning of the pedagogy of languages and subjects like science and mathematics has a significant role in molding the teacher.

In the era of science and technology one cannot neglect the importance of mathematics, which is considered as the key to all sciences. Quality mathematics teaching and learning is a major concern to educators which has a long back history. The current debate among scholars is on what students should learn to be successful in mathematics. The discussion emphasizes the preparation of a student teacher who has mastery in both content and pedagogical knowledge in the subject.

Effective pre-service primary teacher education can be considered as inevitable in providing quality education for all. Quality mathematics education at primary level can be secured only through quality teacher education in mathematics and the preparation of elementary teachers in mathematics is a critical topic in teacher preparation programmes. As a core subject, mathematics is found to be a night mare for majority of students. Sherman and Wither (2003) in a study found that students are having high anxiety and phobia towards mathematics. Studies in the area of mathematics education have found many factors contributing to this. Lack of essential basic knowledge and improper internalization of the subject are some among the major ones that contribute to aversion towards the subject (Vijayakumari & Kavithamole, 2012; Corcoran & Flaherty, 2018). The poor performance of students in mathematics, points to the quality of mathematics education and thereby to the capacity of teachers teaching mathematics at primary level. Whatever changes in the theoretical and pedagogical aspects are brought to the teacher education programme at primary level, to be successful, the student teachers must have thorough content knowledge in the concerned area.

In a study on pre-service primary mathematics teachers, Turnuklu and Yesildere (2007) have concluded that thorough mathematics content knowledge is a necessary but not sufficient condition for effective mathematics teaching. According to them mathematics teachers must be well educated both from “mathematics content knowledge” and “pedagogical content knowledge” aspects in colleges and universities.

Student teachers of the Diploma in Education (D.Ed) programme are academically less strong when compared to student teachers of other initial teacher preparation programmes who are either university graduates or who have succeeded in being admitted into the undergraduate programme. Moreover, Diploma in Education student teachers undergo a packed 2-year programme where they are being prepared to teach five subjects. Teaching mathematics may not be even their choice as all primary programmes are required to prepare generalist teachers regardless of their ability or attitude towards the subjects. It is argued that if the student teachers were able to choose fewer teaching subjects according to their capability and if more time to impart curriculum were given to develop their relevant content knowledge, they would be able to develop their content and pedagogical knowledge more effectively during the pre-service course.

The problem of preparing teachers to teach mathematics effectively becomes severe when student teachers at primary level belong to different disciplines. They are usually found to quit the learning of mathematics by selecting other subjects for higher education. Now the basic qualification to the elementary teacher training course is a pass with 50 percentage marks in the higher secondary examination. The student teachers who got admission to the elementary teacher training course are from different disciplines and all of them who undergo their teacher training need to teach mathematics at primary level for the first year as per the D.Ed curriculum (2013-2017). In the new curriculum of Diploma in Elementary Education (D.El.Ed) implemented in the year 2018 it is mandatory for the student teachers to teach mathematics in first year and second year during their internship. With inadequate understanding of the subject, they are undergoing the training programme and internship. More importance is given by teacher educators to the methodological aspects than the mastery of the student teacher in the content being taught during the training period.

Need and Significance

The Yashpal Committee Report (1993) noted that,

> Inadequate programmes of teacher preparation lead to unsatisfactory quality of learning in schools. ...The content of the programme should be restructured to ensure its relevance to the changing needs of school education. The emphasis in these programmes should be on enabling the trainees to acquire the ability for self-learning and independent thinking.

Improving quality of learning in schools need adequate teacher preparation programme which is capable of developing enough competencies among the student teachers. Frequent curriculum revisions in the field of teacher education both at elementary and secondary level were witnessed in Kerala education sector during the past decade. In Kerala, Trained Teachers Certificate Course (TTC) was restructured into semester system, named as Diploma in Education (D.Ed) in the year 2013. The analysis of the D.Ed curriculum of mathematics points out that less space is provided for content enrichment in connection with the basic concepts of the subject. That pattern was followed in the state for a period of 5 years and was again reformed in the context of evolving a new curriculum named as D.El.Ed. The present curriculum of D.El.Ed is characterised with the following features.

1. Topics in mathematics education are included in all the four semesters.
2. All prospective teachers have to teach mathematics both in LP and UP level as part of internship.
3. Student texts with details on how to transact the selected concepts in different subjects are available.

Even after the latest revision, it is specifically found that the curriculum is not providing sufficient weightage to the content part of the subject. The analysis of both curricula clearly reveals the failure of the system for giving proper recognition and weightage to the mastery of the content part which is quite essential for the prospective teachers at the entry level. This observation becomes more relevant in the context where they are being selected from among various disciplines viz., science, commerce and humanities.

During the past few years, Kerala witnessed all kinds of innovations in the process of teaching and learning in schools under public sector. In view of the accepted doctrine constructivism, 'acquisition' acquired momentum over 'teaching'. The need for identifying and recognizing the innate potential of each learner became widely accepted. The strategic changes came true in teaching of mathematics too. The changes in the teaching of the subject were proposed based on the following assumptions and observations.

1. In the case of teaching mathematics at primary level, ensuring number sense is most important.
2. For creating and ensuring number sense, each learner has to be exposed to certain systematic and organised experiences.
3. In the earlier stage of learning mathematics, the process, E-L-P-S-(Experience, Language, Picture, Symbol) is to be followed which enhances the concept attainment related to mathematical process.
4. Each learner needs to make use of 'Mathematics Kit' which enables him/her to demonstrate the process even in connection with basic operations.
5. At later years in elementary level, process in problem solving gets predominance.
6. Real concept attainment helps better problem solving in later stage of schooling.

Since the period of DPEP (District Primary Education Programme) and the other educational projects in the field, the teacher community underwent massive and intensive training on emerging trends and pedagogic possibilities that evolved across the globe. Workshops were conducted for developing and using variety teaching-learning materials and innovative strategies in subjects like mathematics and science. Practicing teachers developed and used varieties of worksheets and improvised teaching learning materials so as to ensure effective learning of specific mathematical concepts. As a part of this, changes occurred in the process of evaluation too.

In spite of all these changes, student teachers were not properly benefited to experience and enjoy the changes occurred in the teaching of mathematics due to various reasons. Some of them are

1. Limited exposure during the school days leading to weak concept attainment in mathematics.
2. Even those with good conceptual knowledge and sense in the subject do not have the support of strong pedagogy to share the same among the learners.
3. The existing specialization/option procedure which withhold opportunity to all trainees (In D.Ed programme).
4. Lack of good models or best practices in the teaching of mathematics.
5. Use of electronic and digital systems at a larger scale.

More over students with gaps in learning mathematics at school level, those with conceptual errors and with less conceptual clarity need an additional help during their teacher education programme. Though enough reference materials and text books are available to them, there is a lack of consolidated one on the essentials of mathematics at primary level. A student teacher with poor understanding in the content especially with negative attitude will not be taking initiation to locate the content even when they are in need of it during their internship programme.

As a teacher educator, the investigator has the experience of addressing mathematics at lower and upper primary levels. Moreover, as a part of District Practical Examination Board (DPEB), the investigator could also assess and evaluate the teaching competencies and attitude of student teachers in various institutes of teacher education including DIETs. The experiences made him to infer that performance in teaching of mathematics as a core subject is not up to the level or not in harmony with whatever is visioned by Kerala Curriculum Framework (KCF, 2007), National Curriculum Framework (NCF) and Right to Education Act (RTE). Since the prospective teachers are highly ambitious and spirited, their potential and skill need to be addressed and tapped properly and made creative according to the need and demand of future.

It is a notable fact that the subject of mathematics is discussed in all the four semesters of D.El.Ed, but the distribution of the pedagogical aspects is not done comprehensively. No attempts are made to improve the content awareness of students during the programme.

In these circumstances, a prospective teacher with weak content knowledge is not sufficiently supported at the earlier stage of the course. Naturally, it leads to certain inhibitions in the initial stage of teaching and learning the subject affecting their attitudes. In such a context, there is a need for refreshing the content prior to the discussion related to its pedagogical aspect. Otherwise there is a possibility of learning gap in the understanding of the concepts leading to poor performance in teaching. This approach not only helps the students with weak content knowledge, but provides a better clarity to the prospective teachers to have a concrete footing on the content upon which the pedagogical discussions become simple and effective. All the above observations lead to the need for providing a support material or module which is sufficient to bridge the learning gap in mathematics of the prospective teachers.

As a faculty in charge of orienting mathematics teachers, the investigator felt that there is a threshold need for a supporting material to enhance the content knowledge of the prospective teachers. It is also felt that these attempts could derive qualitative changes in the transaction mode of mathematics teaching, leading to better learner outcome.

The investigator also believes that proficiency in teaching of mathematics among prospective teachers will definitely reflect in the field as they are the persons who address the coming generation and the next policy makers. In this circumstance, the investigator decided to develop a Self -Learning Module (SLM) for enhancing the performance in teaching mathematics among prospective teachers at primary level.

Statement of the Problem

Pre- service training of primary teachers is an important task which is multi skill oriented and really challenging to the teacher educators. A very heterogeneous class room and tight scheduled academic activities necessitate some individualized method to fill the gap for developing pedagogical competencies among student teachers. The need of such practices proliferates when it comes to the case of mathematics. An educational programme, whether instructional or self-learning, is expected to bring modifications in cognitive, affective and psychomotor domains. When it comes to the programme on teacher education, emphasis is to be given to the content knowledge, attitude and the teaching. The SLM prepared focuses on the development of these three aspects, collaboratively termed as performance in teaching mathematics. Thus, the present study is entitled as "**DEVELOPMENT OF A MODULE TO ENHANCE THE PERFORMANCE IN TEACHING MATHEMATICS AMONG PROSPECTIVE TEACHERS AT PRIMARY LEVEL**"**.**

Definition of Key Terms

The key terms included in the statement of the problem are operationally defined so that what the investigator has intended by them is made clear.

Development

The dictionary meaning of the term Development is the process of creating a new product or method (Macmillan Dictionary).

In the present study, Development means construction and validation of a self-learning module on Mathematics and its pedagogical aspects at primary level.

Module

Modules are conceptualized as self-contained and self-instructional packages of content or technique, presented in the form of unit frames (Sies, 2003).

Module in the present study stands for a self-learning package on the basic mathematical concepts and its pedagogic analysis. A self-learning module as defined by Dhamija and Kanchan (2014) is a self-instructional, self explanatory, self-contained, self-directed, self-motivating and self-evaluating material.

The present module consists of frames on Arithmetic, Algebra and Geometry. It has two parts, one dealing with the content of the three basic branches of Mathematics, focusing on the primary level; and the second one on the pedagogical aspects.

Performance in teaching Mathematics

Performance in Teaching denotes the level at which a person succeeds in ensuring the learning outcomes in the learners as visualized by the specific curriculum by way of adapting the most suitable instructional strategies (Dave, 1998).

In the present study, the term performance in teaching mathematics stands for three variables viz., Mathematics Content Knowledge, Attitude towards Mathematics and Teaching Mathematics. It is directly related to the content mastery of the teachers, his/her attitude towards subject and the skill to teach. Mathematics Content Knowledge is measured through a test on mathematics content knowledge developed by the investigator based on the fundamentals of mathematics at primary level. Attitude towards mathematics is the score obtained by an individual in a scale of attitude towards mathematics developed by the investigator. Teaching mathematics means the skill of the teacher in the three phases of teaching, planning, implementing and evaluating. It is measured through observation with a schedule on various aspects of teaching mathematics.

Prospective teachers at primary level

The term prospective teachers at primary level means those student teachers who are undergoing the two year Diploma in Education course (D.Ed) under Department of General Education, Government of Kerala.

Objectives of the Study

The major objective of the study is to develop a self-learning module (SLM) that is capable of enhancing the performance in teaching mathematics of prospective teachers at primary level.

The minor objectives set for the study are related to the establishment of need of such a module and its effectiveness to bring changes in Mathematics content Knowledge, Attitude towards Mathematics and Teaching Mathematics of prospective teachers. The following are the minor objectives set for the study.

1. To find out the extent of

   a) Mathematics Content Knowledge

   b) Attitude towards Mathematics

   c) Mathematics Aptitude among prospective teachers at primary level.

2. To compare the pre-test mean scores between control and experimental groups on

   a) Mathematics Content Knowledge

   b) Attitude towards Mathematics

   c) Mathematics Aptitude

3. To compare the pre-test and post-test mean scores of prospective teachers of both control and experimental groups on
   a) Mathematics Content Knowledge
   b) Attitude towards Mathematics
4. To compare the Post- test mean scores of prospective teachers of control and experimental groups on
   a) Mathematics Content Knowledge
   b) Attitude towards Mathematics.
5. To compare the mean gain scores of prospective teachers of control and experimental groups on
   a) Mathematics Content Knowledge
   b) Attitude towards Mathematics
6. To compare the mean score on Teaching Mathematics of prospective teachers of control and experimental groups
7. To test the influence of SLM on
   a) Mathematics Content Knowledge
   b) Attitude towards Mathematics
   c) The scores on Teaching Mathematics of prospective teachers

   when Mathematics Aptitude is taken as a co-variate.
8. To find out the effect size of the developed self-learning module on Mathematics Content Knowledge, Attitude towards Mathematics and the score on Teaching Mathematics of prospective teachers at primary level.

Hypotheses of the Study

The hypotheses formulated for testing the effectiveness of SLM on Performance in teaching Mathematics are:

1. There is no significant difference in the pre-test mean scores of Mathematics Content Knowledge between control and experimental groups.
2. There is no significant difference in the pre-test mean scores of Attitude towards Mathematics between control and experimental groups.
3. There is no significant difference in the pre-test mean scores of Mathematics Aptitude between control and experimental groups.
4. There is significant difference in the pre-test and post-test mean scores of Mathematics Content Knowledge of the control group.
5. There is significant difference in the pre-test and post-test mean scores of Mathematics Content Knowledge of the experimental group.
6. There is significant difference in the pre-test and post-test mean scores of Attitude towards Mathematics of the control group.
7. There is significant difference in the pre-test and post-test mean scores of Attitude towards Mathematics of the experimental group.
8. There is significant difference in the post-test mean scores of Mathematics Content Knowledge of prospective teachers between control and experimental groups.
9. There is significant difference in the post-test mean scores of Attitude towards Mathematics of prospective teachers between control and experimental groups.

10. There is significant difference in the mean gain scores of Mathematics Content Knowledge of prospective teachers between control and experimental groups.
11. There is significant difference in the mean gain scores of Attitude towards Mathematics of prospective teachers between control and experimental groups.
12. There is significant difference in the mean scores on Teaching Mathematics of control and experimental group.
13. There is significant mean difference in Mathematics Content Knowledge between control and experimental groups when Mathematics Aptitude is taken as a co-variate.
14. There is significant mean difference in Attitude towards Mathematics between control and experimental groups when Mathematics Aptitude is taken as a co-variate.
15. There is significant difference in the mean scores on Teaching Mathematics of prospective teachers between control and experimental groups when Mathematics Aptitude is taken as a co-variate.
16. The post-test mean scores on Mathematics Content Knowledge, Attitude towards Mathematics and the mean score on Teaching Mathematics of prospective teachers of Experimental group are significantly higher than that of control group.

Methodology

The study is to construct and validate a Module on mathematics teaching. The effectiveness of the constructed module was established using Quasi-experimental design with Pre-test- post-test non-equivalent groups. A survey was conducted to establish the need of a self-learning module on basics of mathematics for prospective teachers. So mixed method was adopted for the conduct of the study.

Instruments used for the study

Following instruments were used for the study

1. Scale of attitude towards Mathematics (Saheedali & Vijayakumari, 2013)
2. Mathematics Aptitude Test (Malini & Sumangala,1996)
3. Test on Mathematics content knowledge at primary level (Saheedali, & Vijayakumari, 2013)
4. Observation Schedule for assessing teaching of mathematics (Saheedali, 2015)
5. Self-learning module in Mathematics and its digital version. (Saheedali, & Vijayakumari, 2015)

A rating scale was also used to rate the quality of the developed module by teacher educators of different institutes of teacher education and DIETs.

Participants

A survey on the Mathematics content knowledge and Attitude towards Mathematics was done to find out the extent of these variables among prospective teachers. The participants of the survey are 100 prospective teachers from five institutes of teacher education from four revenue districts viz., Thrissur, Palakkad, Malappuram, and Kozhikode.

The developed module is intended to enhance performance in teaching Mathematics of prospective teachers at primary level in Kerala. Hence the module was validated by applying it to an intact group of 40 prospective teachers at primary level of DIET Palakkad treated as the experimental group who used the SLM together with the regular pre-service teacher education programme and 40 prospective teachers from DIET Malappuram as control group who have undergone regular pre-service teacher education programme at primary level.

Statistical Techniques

The tabulated data was analysed using Statistical Package for Social Sciences (SPSS) as per the objectives of the study. Preliminary statistics like mean and standard deviation was calculated. The inferential statistics used for testing hypotheses are:

1. Test of significance of mean difference for two large independent groups.
2. Test of significance of mean difference for large dependent groups.
3. Analysis of Co-variance.
4. Cohen's d for calculating the effect size.

Scope, Delimitations and limitations

It is essential to have sufficient mathematics content knowledge for effective mathematics teaching. To be a successful teacher, one need a positive attitude towards the subject. In the present study the investigator developed a self-learning module on mathematics that may help the prospective teachers at primary level to improve their mathematics content knowledge and Pedagogical approach. Confidence on mathematics content knowledge may create a positive attitude towards the subject.

The study used Experimental and Control groups as intact groups of students of two DIETs at Palakkad and Malappuram districts of Kerala to find the effectiveness of the module. Standardized instruments were used to collect the data and the effect size of the module on mathematics content knowledge, attitude towards mathematics and teaching was calculated. It is expected that the prospective teachers will be able to understand comprehensively the basic mathematics and pedagogic knowledge of the concepts related to fractions. They will be capable to handle the class room activities of lower primary and upper primary mathematics easily with the assistance of the self-learning module. The module will also be beneficial to the in-service teachers.

A survey on the initial level of MCK and attitude towards mathematics was conducted among prospective teachers. The results of the MCK test administered among prospective teachers at primary level evidently showed that they are weak in mathematics. The module was developed based on the essential basic mathematics in different branches like arithmetic, algebra and geometry.

Delimitations

1. Though D.Ed Course is conducted in Kerala by Government, Aided and Unaided institutions, the investigator selected only DIETs for the conduct of the study.
2. The module developed contains only the basics of mathematics at primary level.
3. The pedagogical part of the module was focused on the weaker area of the content for the prospective teachers on the basis of the responses on MCK test.

Selection of D.Ed students of intact mode was really a challenge to the investigator due to many reasons. Variation in the time schedule of the course in various districts was one among them. Limited numbers of government institutions are there in each district. In this context, the investigator selected two districts viz., Palakkad and Malappuram districts of Kerala State for the conduct of the study. This helped the investigator to administer the module and assess the academic progress at its minute perspective.

Limitations

Some limitations noticed by the researcher are

1. The regular classes of the control group were taken by the teacher educator in charge of that institution, not by the investigator. But, the control group is taught by a qualified teacher educator who appointed as per the norms of government and NCTE.
2. Only one class of the prospective teachers was observed by the researcher for

which an observation schedule was adopted. The observation schedule used is the one which usually used by the teacher educators for assessing the teaching of D.Ed students.

3. Though the study warrants multi variate analysis of variance, as the preliminary conditions for MANOVA were not satisfied by the data, univariate analyses were executed which made the validation process more elaborated.

The survey on MCK and Attitude towards Mathematics was conducted on a sample of 100 student teachers of the previous batch and not of the same batch on which the effectiveness of the module was experimented. This was done with the assumption that the entry level of student teachers of D.Ed course will not be remarkably different in consecutive years. The pre-test scores of experimental and control groups were also compared to know the status.

Organization of the report

The study is presented in five chapters. Chapter one contains the general introduction and the relevant details of the problems under the study. The chapter two narrates the theoretical aspects of the present study and the review of related studies pertaining to the topic under investigation. The Third chapter gives a description of the method of investigation, the sample selected, the instruments and techniques adopted for conducting the study, the procedure employed for collecting data and the statistical techniques. The fourth chapter presents how the data were analysed using appropriate statistical techniques. The fifth chapter describes the details of the summary of the study, Major findings, conclusions and suggestions for further research. Again the report is followed by references and a series of appendices pertaining to the study.

Chapter 2

REVIEW OF RELATED LITERATURE

- Theoretical Overview
- Review of Related studies

Review of related literature allows the researcher to acquaint himself with the current knowledge in the field in which he is going to conduct the research. By reviewing the related literature the researcher can select a fruitful, not much explored research area. Review helps the researcher to plan about the method, the instruments to be used and the knowledge of findings of previous studies helps the researcher to discuss the new findings in a meaningful way. Thus review of related literature is one of the most important steps in a research.

This chapter deals with the review of related literature categorized into two sections viz, Theoretical overview of the module and the review of related studies.

In the section, ' Theoretical overview of the module, an attempt was made to explain the salient features and characteristics of a modular approach and the significant steps of the development of a module. An overview of teaching and teaching performance is also attempted. In the section 'Review of related studies', a review of related studies in the area of Mathematics teacher education as well as the development of self- instructional modules are considered.

Theoretical Overview

Individualized instructional techniques are appropriate learning strategies that can be adapted to suit different learner characteristics. It permits the child learn independently at his/her own pace according to his/her interests and abilities. According to Nathan (2009), individualized instruction is based on two basic assumptions: Learning results from the students' own effort and learning how to learn is the primary ingredient of education. The Secondary Education Commission (1964-66) has also emphasized the need for individualized instruction. To increase learner participation in the teaching-learning process, educationists, psychologists and philosophers give emphasis on pupil dominant approaches.

Modular approach is an attempt at individualization of instruction and it meets the needs of today's students more adequately than the traditional approaches both with respect to the quality of learning and content. It has emerged as one of the most promising alternatives mainly due to its emphasis on individualized learning and its adaptability to large numbers of students. It is also an answer to the great differences in 'how' each student learns. This approach uses modules for better learning.

Russel (1974) defines module as an instructional package dealing with a single conceptual unit of subject-matter. Modules are designed to help the students accomplish certain well-defined objectives. The learners can go through the material at their own pace and at their own time. They may also be used to complement instruction. Modular instruction is self-contained, self-learning and self-explanatory in nature. In this technique, the learning becomes self-initiated and self-directed.

Features of Modular approach

Learning points are presented in small steps of objective based learning activities. Active student involvement is possible in learning because the teacher is not directly teaching the students, but the students themselves engage in activities due to the strategic directions given by the implementing teacher. Each pupil can learn according to their mental ability and thinking. Thus modular approach becomes self-pacing. It provides occasion for individual attention to all students and hence the learners get a rich and rewarding learning experiences through this approach. Conceptually it is a mastery learning strategy and it refers to the pedagogical concept that learning must be thorough. Hence one learning point is to be attained before the next one.

Another important feature of this approach is that a teacher can focus on students' backwardness in the subject matter and can compensate in the class itself. That means the feedback can be tested immediately through formative evaluation. The way of assessing the progress of students' progress is much easier in this approach. Teacher gets enough opportunity to interact with the students. Skinner and Holland (1958) suggested the principles of modular approach as small steps, active student involvement, immediate confirmation, reinforcement and self-pacing.

Advantages of Modular approach

The use of Modules provides an opportunity for organizing numerous sequences of experiences to reflect special interests of the teacher or the learner. It provides a way of assessing the students' progress in each and every step of the learning. Modules reduce the routine aspects of instruction, leaving the teacher free to engage in personal contact with the students. The independent nature of the instructional units facilitates the updating of study materials without major revisions.

With regard to the students, they can progress at their own pace since they have full control over the rate of study. Each student can master each module before proceeding to the next. Students can participate in the decision making about whether she/he has learned the subject matter adequately or not. It may be practical for some modules to be checked out and studied at home resulting in saving time for both students and teachers. In modular instruction each student has the opportunity to develop a sense of responsibility for her/his learning.

Module

Modules are known by a wide variety of names from 'learning- packs' to 'mini-courses'. According to the International Encyclopedia of Education (2010 p.3886), a module is a unit of curricular material, complete in itself, to which further units may be added for the achievement of larger tasks or more long-term goals. Creager and Murray (1971) defined module as "a self-contained and independent unit of instruction with the primary focus on well-defined objectives." A module as a self- contained unit, offers variety and adaptability to the instructional process. It can be used by individual or small groups of learners in a variety of learning situations. A module may be of several minutes or several hours long. According to Sharma (1990), "A module is a learning package which contains everything needed by the students for self-instruction. A module contains three basic elements of instruction viz. objectives, learning activities and evaluation." The rationale behind a module concept of learning has a sound basis in learning theory. Modules take into account individual learning styles, are flexible to meet various learner needs, and place maximum responsibility on the learner. Modules also provide for active participation by the learner and gives opportunity to learn by doing.

Kokila (2006) in a book Instructional Technology and Curriculum Development, has explained the components of a module as Statement of purpose, Desirable pre requisite skills, Instructional objectives, Diagnostic pre-test, Implementers for the Module, Modular programme, Related experiences, Evaluative post-test and Assessment of the Module.

The essential components of a module as suggested by Sharma (2005) are

- **Rationale:** Generally a module contains the rationale, objectives and the materials. It will motivate the learner to go through the module effectively.
- **Objectives**: The expected outcome of the module stated in behavioural/ performance terms are its objectives. The learner is informed about the expected learning outcomes of the module.
- **Entry test**: It includes items/activities to test whether the learner has essential pre-requisites to go through the module.
- **Multi-media materials**: To cater the needs of the learners, optimum utilization of senses and active participation of students, a variety of media are to be used.
- **Learning activities**: Presentation, demonstration, simulation, discovery, problem solving etc. may be useful. A wide variety of learning activities increase student interest and cater student needs
- **Self-test**: At the end of each section, a set of activities are to be given in the module.

- **Post-test**: To check whether the objectives are attained, items/activities are to be given at the end of the module.

According to Minnick (1989) the structure of a module is,

- Title
- Introduction
- Instruction to the users
- Objectives
- Learning activities
- The formative test
- Evaluation and feedback.

Modules should start with an introduction to the topic. It should include the instructions and suggestions about how it can be used successfully. If a module is to be used under the supervision of an instructor, only oral directions are needed. In almost all cases printed instructions on how to use the module, is a part of the module. The instructor and the student can compare the answers and discuss the concept learnt from the module. At the end of the module, the learner should discuss the activity with the teacher individually or in small groups. It is important for the instructor to monitor each learner's progress in order to reward success or avoid frustrations Koul(1989).

Development of a Module

A unit of a syllabus can be divided into sub units and then the sub units can be divided into learning points. These learning points are arranged in a sequential order from simple to complex and can be presented in different stages. Learning activities suitable for attaining the pre-determined instructional objectives are prepared. Learning situations for active student involvement are needed for the attainment of the objectives. While the students are engaging in these activities, formative evaluation should also be taken place individually. Diagnosis should be made using formative tests. So, in the module immediate feedback and confirmation activity is to be given after each learning activity. After confirmation of the learning point, reinforcement activity should be given. The student must gain mastery of one learning point before proceeding to the next. According to Sharma (2000), the following steps can be used for the development of a module:

- Identify the target group.
- Identify the learning needs of the group.
- Decide the terminal behaviour of the group.
- Identify the entry behaviour.
- Assess the entry behaviour through pre-test.
- Prepare teaching frames incorporating objectives, learning activities, formative evaluation and summative evaluation.
- Try out the module.
- Revise and finalize the module.

Teaching Profession

According to Palmer (1994), teaching is the process of attending pupil’s needs, experiences and feelings, and making specific interventions to help them learn particular things. Considered to be more than professionals, teachers are regarded as the strongest pillar of the society. Teaching is a profession that is the mother of all other occupations. A teacher is like a potter who delicately shapes impressionable minds of the disciples and moulds it into vessels that define each individual's perception and ambitions. Teachers are always been respected in all societies.

Quality improvement and teacher's professional development

Teacher's Professional Development (TPD) is the professional growth that a teacher achieves through increased experiences and examination of his or her teaching systematically. The concept of professional development is broader than career development which is the growth that occurs as the teacher moves through professional career cycle. Sometimes staff development is considered synonymous to professional development though staff development is generally used in reference to in-service training. The United Nations Educational, Scientific and Cultural Organization brings seven components of professional development such as constructivism, long term process, process that takes place within a particular context, intimate linkage to school reform, encouragement, reflective practice and collaborative effort, a different look in different settings.

Through the course of their career, teachers have to move from pre-service to in-service professional development courses. Various types of in-service programmes such as orientation programmes, refresher courses, seminars, workshops etc. are organised at the central, state, regional, district and institutional levels. The main focus of these programmes is the professional development of teachers. Teachers must not think of themselves as confined to the classroom. Teaching is a practice-based profession similar to medicine or law. This means that a teacher's value or contribution is likely to grow with experience and age. However, for this to be true it is important for teachers to invest effort in their own professional development.

Like any profession, teaching also has its fair share of challenges like low compensation, lack of resources or autonomy to adapt the teaching-learning methods, limited opportunities for career progression and excessive responsibilities. For example, teachers are often given additional administrative duties not related to education or asked to teach at multiple stages in a school. All these challenges are very real and need to be addressed in a positive way. However, there are ample examples of people who are passionate about helping learners achieve their potential or contributing to society through teaching that have gained immense satisfaction from teaching.

Teaching Performance

Teaching is the task of a teacher which is performed for the development of a child. Teaching performance is a set of teacher behaviour while teaching in a class. It is a product of interactions between teacher characteristics and teaching situation. It is often used as a basis from which teacher effectiveness can both logically and empirically be inferred.

There are five performance areas as suggested by Dave (1998) on the basis of job and need analysis in order to improve quality and efficiency of the school education. The areas are

- Performance in the Classroom – including teaching and learning processes, evaluation techniques and classroom management;
- School-level Performance – including organization of morning assembly, celebration of national, social and cultural events, and participation in school-level management;
- Performance in Out-of-School Activities – such as field visits, work centre visits, etc;
- Performance Related to Parental Contact and Co-operation – such matters as enrolment and retention, regularity in attendance, discussing progress reports, improving quality of achievement, etc.
- Performance Related to Community Contact and Cooperation – comprising issues like village education committee work, joint celebration of certain events by school and the community, eliciting community support for the development of school etc.

Obviously, these performance areas will give rise to a series of practical activities which not only include the present programmes of 'teaching practice' in a more realistic and effective manner covering evaluation procedures and classroom management in different situations such as multi-grade teaching, but also include other important educational responsibilities in which the teacher should be given adequate practical training to develop relevant skills. Thus, in the field of practical training, these performance areas mark a major shift from mere teaching practice to an overall educational practice expected of the teachers in meeting the school, out of school and community needs and aspirations.

In order to equip the teachers well in these performance areas and to enable them to become thoroughly competent to carry-out these professional tasks with efficiency and insight, competency areas are designed not simply to provide adequate theoretical and conceptual understanding but to empower the teachers to perform their responsibilities with professional insight and confidence. Teacher competencies include relevant conceptual content, contextual, transactional and evaluation aspects. All competency areas thus identified converge on one or more of the performance areas and interrelates theory and practice in a focused manner.

Teaching Competency

Competence is personal traits or a set of habits that leads to more effective and superior job performance. Teacher competence includes a thorough knowledge of the content. A teacher's competency mainly includes the strategies, understanding of student psychology and the process of learning. Synder and Drumon (1988) defined competency as a complex set of relationship between one's performances. In the context of teaching, competency means the right way of conveying units of knowledge, application and skills of students (Shukla, 2010).

Here, the right way includes knowledge of content as well as processes, and methods of convening in an interesting way. Rama (1979) defines teacher competency as the ability of a teacher manifested through a set of overt teacher classroom behaviours which is a resultant of the interaction between the input and the product variables of teaching within a social setting. Teaching competency means an effective performance of all the observable teacher behaviours that bring about desired pupil outcomes. Based on the micro-criteria approach to study (Gage,1963), teaching is perceived as a set of attitude, content knowledge and teaching skills where in a teaching skill is a set of teaching behaviours that facilitate or bring about a specific instructional objective. In other words, teaching competence involves effective use of these various teaching components.

Teaching Skills

Teaching skill has been identified by Gage (1963) as specific instructional activities and procedures that a teacher may use in his classroom. These are related to various stages of teaching or in the continuous flow of the teacher performance. The teaching becomes effective when the core components viz., writing instructional objectives, organising the content, creating set for introducing the content, introducing the lesson, preparation of suitable learning activities and learning materials, response management, explaining, illustrating with example, stimulus variation, promoting pupil participation, giving assignments and evaluating pupil's progress in learning etc are possessed by the teacher.

Conclusion

Modular approach individualizes instruction and is applicable in a wide range of teaching learning processes. A module is a systematic presentation of the content with clear indication of the purpose, instruction, activities, evaluation and feedback. It helps the learner to learn at his own pace and convenience. Performance in teaching is a net result of content knowledge, attitude and teaching skills of the teacher. To ensure the quality in teaching and to become a successful teacher, one should have a positive attitude towards the subject, thorough content knowledge and the desirable teaching skills. A modular based instructional material will help the teachers to get clarity in the concepts, pedagogical support leading to a positive attitude towards the subject.

Review of Related Studies

Under this section, studies in the area of Mathematics teacher education and use of instructional modules in teacher education are presented. Studies in Mathematics teacher education are classified into those related to content knowledge, Attitude towards Mathematics and Teaching.

Mathematics Content Knowledge

Ekawati, Lin and Yang (2018) conducted a case study on two mathematics teachers teaching the concept of ratio and proportion. Video observation of the classes of these teachers revealed that teacher with good Mathematics Content Knowledge (MCK) and Mathematics Pedagogical Content Knowledge (MPCK) performed well when compared to the performance of teachers with low MCK and MPCK. They concluded that MCK and MPCK are very essential for mathematics learning.

Ovez and Akar (2018) in their study analysed the content knowledge on graphs of pre-service elementary mathematics teachers from an anthropological perspective on 112 pre-service elementary mathematics teachers. Concentric mixed pattern research method has adopted in the study. The data was collected through Graphic Content Knowledge Scale and interview method in order to examine the content knowledge of primary school mathematics teacher candidates related to graphics anthropologically. As a result, it has been observed that the individual recognitions of pre-service teachers related to column, circle and line graphs conform to the institutional recognitions, however in institutional recognitions the techniques specified for column graphs are being used for histogram. Hence they have difficulties in comprehending the differences between histogram and column graph. It has also been identified that they lack on a theoretical knowledge on graph.

Guberman (2016) evaluated subject mathematics knowledge of Pre-Service teachers in order to design the appropriate course. Teaching arithmetic involves knowledge about the essence of the concept of "number" and the development there of, calculation methods and strategies. properties of operations on different sets of numbers, as well as the properties of the numbers themselves. The study investigated, how to educate Pre service Mathematics teachers in order to supplement their mathematical knowledge with the required components, the development of arithmetic thinking among pre-service teachers intending to teach mathematics at elementary school, was done by matching the Van Hiele theory of the development of geometric thinking to arithmetic. The finding of the study indicates that, this approach of the learners' level of thinking development might lead to meaningful learning in arithmetic course for PMTs.

Livi and Herbert (2016) conducted a study about the primary pre-service teachers' mathematical content knowledge during practice teaching. It is recognised that a teachers' mathematical content knowledge (MCK) is crucial for teaching but less is known about when different categories of MCK which develop during teacher education. This study reported on two categories of primary pre-service teachers, whose MCK was investigated during their practice experiences in first, second and fourth years of a four-year Bachelor of Education program. The results of the study revealed that the developed categories of their MCK during practice were assisted them in providing breadth and depth of teaching experiences, sustained engagement for learning MCK and their quality of learning experience.

Tom and Robyn (2016) investigated the pre-service teachers' mathematics content knowledge (MCK) and beliefs in connection with mathematics education practices. An Exploratory Factor Analysis, conducted on a beliefs and attitudes questionnaire, produced three common attitude factors associated with (1) inquiry-based teaching; (2) how mathematics knowledge is acquired; and (3) the application of mathematics. These factors were used in subsequent multivariate analyses to find out whether teachers' mathematics competency is influenced in their personal mathematics approaches of viewpoints and perspectives. No significant difference was identified between those students who had studied advanced and standard mathematics concepts at school level on these three beliefs and attitude of measures, despite of their MCK.

Tutak and Adams (2016) examined the pre service elementary school teachers' geometry learning as investigated by both qualitative and quantitative methods. For the qualitative investigation, narrative analysis and thematic analysis methods were used. The findings of narrative analysis indicated two main kinds of components: as a learner and as a beginning teacher. The thematic analysis yield to three themes: history of learning geometry, perceptions about geometry, and effective geometry instructional practices. The findings of the study informed the quantitative investigation on geometry content knowledge for the case of quadrilaterals. During the second phase of the study, 102 participants who enrolled in the course and completed the pre and post test of teachers' geometry content knowledge. Treatment group participants (n=54) received series of activities (geometry activities and student work analysis) weightage on quadrilaterals, and control group participants (n=48) received traditional instruction. Results revealed that a significant change in treatment group participants' geometry content knowledge and a significant main effect of knowledge but no significant interaction between geometry content knowledge and grouping. Even though treatment group participants' geometry content knowledge growth was significant, the difference between treatment group and control group participants' growth in geometry content knowledge was not significant.

Mapolelo and Akinsola (2015) conducted a research on teachers' mathematics knowledge. The paper has been concluded in five main areas: (a) the role of subject matter knowledge in teaching and learning, (b) teachers' beliefs about mathematics teaching and learning, (c) beliefs and beliefs-in-practice: inconsistencies, (d) teacher education and its impact on instructional practices, and (e) future research on teachers' mathematics knowledge. The study indicated that teachers are critical factors in the learning of mathematics and the extents of their content and pedagogical knowledge do determine students' achievement. Also, the paper acceded to the view that, a teacher's memories from the school years is a central influencing factor that affects mathematics related beliefs, hence there is a need to enhance pre-service teachers' positive attitude towards mathematics during training. They suggested that further areas of research should look at: different theoretically and empirically distinction in content knowledge for teaching and investigate their relationship, separately and in combination, to student achievement; whether teachers' mathematics knowledge affects their lesson planning strategies and whether the provision of 'mathematical knowledge for teaching' from teacher training institutions can improve pre-service teachers' beliefs about mathematics and mathematics teaching. The study concluded that, mathematics teacher education programme should provide an awareness of conception in mathematics to the pre service teachers which may influence their teaching.

Kilic (2014) investigated the pre-service primary teachers' knowledge structures of fraction through problem posing activities. A total of 90 pre-service primary teachers participated in this study. A problem posing test consisting of two questions was used and the participants were asked to generate as many problems based on the following conditions: i) using both 1/2 and 3/4 fractions, and ii) using either 1/2 or 3 /4 fractions. Data were analyzed using both semantic and constant comparative analysis techniques. The results of the study showed that there was a substantial diversity in the problems posed by pre-service primary teachers. Moreover, participants preferred to pose story and symbolic equations in first task and story equation in second task. Furthermore, the participants faced some issues related to fractions such as not realizing 1/2 + 3/4 situation is more than 1, missing data, choosing wrong number, using different fractions and posing non-fraction problem.

Lingam, Limgam and Raghuwaiya (2014) conducted a study that focuses on pre-service teachers' professional development during the teaching practice. The participants were final year students of Bachelor of Arts and Bachelor of Science with Graduate Certificate in Education programmes of a university of Fiji. Analysis of the data obtained using a survey questionnaire indicates that overall, the pre-service teachers were satisfied with the practicum experience. This is assumed to demonstrate that the practicum experience contributed well towards their professional preparation for work expected of them in Fiji secondary schools. The study concluded that for improving the preparation of teachers the identified areas are to be strengthened.

Kieboom (2013) analysed the mathematical knowledge among 24 pre-service teachers' by examining their reflections on teaching about the meaning of fractions to a small group of students in the field of an elementary mathematics experience. Excerpts from journals were used to describe the aspects of mathematical knowledge for teaching and emphasize the content of their reflections. Study revealed that how mathematical knowledge for teaching assists pre-service teachers in analytically reflecting on various aspects of teaching and learning, thus making reflection more productive.

Topcu and Temiz (2013) explored the relationship between pre service teachers' teacher efficacy beliefs and their constructivist-based teaching practices. Data were gathered through the questionnaire (Teachers' Sense of Efficacy Scale) and the observation schedule (Reformed Teaching Observation Protocol) administered to the participants. Participants of the study were 101 pre service teachers' (53.5 % from science and 46.5 % from mathematics) from a university in eastern part of Turkey. Qualitative data were also used in order to substantiate quantitative data. The semi-structured interviews were conducted with 20 pre-service teachers who voluntarily participated in these interviews. Finding of the study showed that pre-service teachers' constructivist-based teaching practice was positively correlated with their teacher efficacy beliefs. To conclude, pre service teachers following constructivist approach shows high teacher efficacy in their teaching while pre service teachers' following traditional approach show low teacher efficacy in their teaching.

Grandgenette, Rech and Matthews (2010) conducted a research study about the mathematical deficiencies of pre-service elementary teachers, many teacher preparation programs are requiring mathematical content courses specifically focusing on the mathematics taught at the elementary level. The study considers the impact of the courses (one course focusing on Arithmetic, and the other course focusing on Geometry and Measurement) had on the mathematical content knowledge and attitude towards mathematics. The courses were implemented on the experimental group consisting of 19 pre-service teachers and a group consisting of 19 pre-service teachers of another college was taken as control group. Results indicated that those teachers who took the specialized content courses had significantly higher mathematical content knowledge compared to those pre-service elementary teachers who took more general mathematics courses, but not significantly better attitudes towards mathematics.

Perry (2010) investigated pre service elementary teachers' achievement goal orientations for learning mathematics and the relationship of those goals to their attitudes toward mathematics. Self-reporting instruments were administered to assess three achievement goals such as mastery, performance-approach and three constructs of attitude-confidence in learning mathematics, usefulness of mathematics, and mathematics as a male domain. The study found that pre service teachers were higher in mastery goals than in performance goals, and performance-avoid goals were higher than performance approach goals. Mastery goals correlated positively to all three constructs of attitude. The findings recommend that mathematics content courses for pre service elementary teachers should be taught in a classroom climate that supports and encourages mastery goals.

Tio, Chua, Cheang and Yeo (2007) conducted a study on the development of the diploma in education students' pedagogical content knowledge. For the study, a 16 item instrument was developed by the investigators to measure the pedagogical content knowledge of the D.Ed students. The instrument was administered on the Diploma in Education student teachers at the National Institute of Education, Singapore at the beginning of their programme and was re-administered after they completed their methodology course. The study found that student teachers at the beginning of their programmes are generally quite weak in their mathematics pedagogical content knowledge, but showed a significant improvement in some aspects of Mathematical pedagogical content knowledge on completion of their mathematics pedagogy course.

Corcoran (2005) conducted a study in relation with the mathematics subject knowledge if Irish primary pre-service teachers. The purpose of the study was to establish what mathematics Irish primary school student teachers bring to initial teacher education. The investigator developed a tool SKIMA involving 16 items on the aspects of Mathematics content knowledge. The study was conducted in the assumptions that a certain kind of mathematics subject knowledge is needed for teaching. Three recently published curriculum implantation studies were also assessed by the investigator. The findings of the study revealed that the subject knowledge of the pre-service teachers were very low at the initial stage of the course.. Also the study suggested providing a background in mathematics subject knowledge for the primary pre-service teachers.

Southwell and Penglase (2005) conducted a study among Seventy eight primary pre-service teachers in a survey of arithmetical content knowledge at the conclusion of an elective mathematical content course designed for those with a poor background in mathematics. Not only was the aim of this first stage of a research project to ascertain current knowledge but also to adjust current courses to better suit the students in teacher preparation courses. The results of this survey indicate the weaknesses in understanding in particular areas including place value, operations with common fractions, multiplication of decimal fractions, percentages and measurement.

Tsang and Rowland (2005) investigated into the Subject matter knowledge of primary school mathematics teachers. The study was implemented on 72 Hong Kong primary mathematics teachers. A mathematics subject audit instrument used by researchers in England was adapted for an initial exploration into teachers' mathematics subject knowledge. The collected data were analyzed and compared with the results of a mathematics subject audit undertaken by a teacher training institute in England. The SMK of an 'convenience' sample of primary school mathematics teachers was found to be relatively shallow despite of the outstanding mathematics attainment of students in recent international comparative studies The results of this study also show that the participating teachers with the minimum of mathematics attainment in school leaving public examinations performed significantly poorer than the rest of the sample.

Goulding (2003) investigated the Mathematical knowledge of pre-service primary teachers. This study reported the collaborative research into the mathematical subject knowledge of elementary pre-service student teachers by a group of researchers from four English Universities. It will discuss some of the specified knowledge and understanding which the government deemed to underpin the effective teaching of mathematics at the elementary level (for ages 5-11), the way in which the institutions investigated and addressed weaknesses in this knowledge, the self-assessments made by the trainees and the link between this knowledge and teaching competence. Amongst the questions raised are: What mathematical knowledge is important for primary ii teachers? If we address weaknesses in mathematical knowledge in training, what difficulties in teaching will the trainees still expect to meet? Findings of the study indicates that the students were felt difficulty in learning of the concepts about terminology, shape and space, and the equations and graphs of straight lines. Also they need improvement in acquiring the concept of theory with proof. Study suggests that teachers may try to develop confidence and positive attitudes among students through creative works.

Kaminsky (2003) conducted a study on the reflection and the development of reflective practices that assist pre-service student teachers in the integration of their learning experiences and in the analysis of their actions in their endeavours to become more effective learners and teachers of mathematics. In this qualitative study, and through the use of journals, students reflected on their experiences in a number sense programme and on various aspects related to the teaching and learning of mathematics. The major findings include through experiences in the number sense programme, positive developments occurred in student teachers' understanding, learning and teaching of mathematics. Student teachers not only actively participated in mathematical discourse, constructed and communicated mathematical knowledge, but also engaged in approaches which appeared to promote the interrelationships among their mathematical knowledge, understanding and experience. A number of student teachers exhibited characteristics of reflective thinking in mathematics and engaged in approaches which appeared to assist in broadening previously held views on learning and teaching mathematics.

Attitude towards Mathematics

Niepel, Burrus, Grieff, Lipnevich, Brenneman and Roberts (2018) investigated the students' beliefs and attitudes towards mathematics on the basis of theory of planned behaviour. They examined the predictive validity of mathematics beliefs and attitudes, modelled using the four key constructs of the TPB (i.e., intention, attitude, norms, and control) on mathematics. Furthermore, they explored the longitudinal interplay among these key constructs of the TPB. Study was conducted on a sample of 752 students at Time 1 and 514 students at Time 2. The outcomes of the study provide the first longitudinal support for the validity of a mathematical beliefs and attitudes which strongly rooted in the Theory of planned behaviour.

Tabuk (2018) conducted a study in connection with the Attitudes towards Teaching Mathematics among prospective primary school teachers. A total of 236 prospective primary school teachers were examined in order to investigate the effect of gender and program differences on their attitudes towards teaching mathematics. The results revealed that the prospective teachers have positive attitude towards teaching mathematics. It was also found that gender and grade level are not significant factor on attitude scores.

Ali, Mustaque, Shah and Raheem (2017) explored the differences of attitude towards Mathematics in male and female students. Sample of the study, 400 students (200 male and 200 female) were selected through simple random method. The Scale of Mathematics Related Attitude (SOMRA) was used for measuring attitude towards Mathematics. The analysis showed non-significant difference in the attitude towards Mathematics of 10^{th} grade male and female students.

Ajisuksumo and Sabutri (2017) conducted a study to find out the influence of attitudes towards mathematics and meta-cognitive awareness on mathematics achievement of high school students. The respondents of this study were 103 students of a senior high school in Tangerang, Indonesia. Attitudes towards Mathematics Inventory (ATMI) was used to measure students' attitudes towards mathematics, and Meta-cognitive Awareness Inventory (MAI) was used to measure meta-cognitive ability, whereas mathematics achievement was measured from the value obtained in the school report cards of the semester when the research was being conducted. The results revealed that attitudes towards mathematics and students' mathematics achievement were significantly correlated. No significant correlations were shown between meta-cognitive skills and mathematics achievement, as well as between attitude towards mathematics and meta-cognitive skills. It was also shown that the attitude towards mathematics contributes to the model, but not the meta-cognitive skills. There was no significant gender difference found on mathematics achievement.

Altiner, Gokubulut, Yorulmaz and Onal (2017) investigated the relationship between Pre-Service class teachers' Self-Efficacy in Mathematical Literacy and their Attitude towards Mathematics. The sample of the study was 274 pre-service teachers who were determined purposefully. The finding indicates that the teachers' self-efficacy in mathematical literacy and their attitude towards mathematics are related at a medium level. There was a significant difference in self-efficacy in mathematical literacy and attitude towards mathematics with respect to grade level, but no significant difference was found in the case of gender and academic average.

Ardana, Sariyasa and Murni (2017) conducted a study about the assistance of Geogebra discovery learning model for problem solving ability and attitude towards mathematics. Quasi experimental and post-test only control group design was used in this study. The participants in the study were 181 students. The results of the study show that the utilization of GeoGebra in discovery learning can lead to better problem solving and attitude towards mathematics. The presentation of problems using Geogebra can assist students in identifying and solving problems and attracting students' interest because Geogebra provides an immediate response process to students. The results of the research also revealed that the utilization of Geogebra in the discovery learning can be applied in learning and teaching wider subject matter.

Ayob and Yasin (2017) studied the various factors that affect the attitude towards mathematics, including factors related to opportunity to learn. The results showed that attitude towards mathematics is influenced by three key factors of opportunity to learn, that are content coverage, teaching practice and teaching quality.

Carrol, Hourigan and Leavy (2017) studied the entry-level mathematics attitude of pre-service primary teachers entering an initial teacher education (ITE) programme. Attitudes of 360 pre-service primary teachers were compared to 419 pre-service teachers entering the same college of education almost one decade later. The latter experienced reform school mathematics curricula compared to the earlier group who experienced traditional curricula. Attitude was measured by administering Aiken’s Revised Mathematics Attitude Scale. The results indicated that pre-service teachers have positive attitudes on entry to ITE. The earlier cohort demonstrated greater Enjoyment of Mathematics while the latter cohort exhibited higher scores on the value of Mathematics scale.

Celik (2017) conducted a study about pre-school teachers' attitude towards mathematics and mathematical development among 6-year-old pre-school pupils. The sample of the study was 30 teachers working with 6 years old students and their 120 students of public kindergartens and independent pre- school classrooms in Erzurum City. Attitude towards mathematics education were measured using the "Pre-school Teachers' Attitudes towards Early Mathematics Education Determination Tool" and the quantity levels of development of mathematics in children were measured using the tool Progress in the test of mathematics at grade 6. Results revealed that there was a positive and significant relationship between the preschool teachers' attitudes towards mathematics and the mathematics development in 6-year-old preschool children.

Elci (2017) studied the students' attitudes towards mathematics. The study was conducted on high school students from Turkey through quantitative and qualitative methods. The data was collected through the scales named Mathematics Attitude Scale (MAS) and Mathematics Teachers' Approaches Questionnaire (MTAQ) and the semi–structured interviews. The MAS was used to determine the students' attitude towards mathematics and the MTAQ was used to assign mathematics teachers' activities and approaches in their lessons. The study was conducted on 450 students (253 female and 197 male) and the interviews were carried out with the 25 students chosen from the sample. The study showed that the students' attitude towards mathematics differed by gender, field, and mathematics score but not by grade and the teachers' approaches and activities influenced the students' attitude towards mathematics in some aspects.

Karjanto (2017) investigated the attitude toward mathematics among the students enrolled in the foundation programme at Nazarbayev University. There were 55 males, 53 females, 73 Mathematical-Physics (MP), 22 Biology-Chemistry (BC) and 13 International Relations-Economics (IRE) students. The study found that they possessed a positive attitude toward mathematics, with mean and standard deviation 3.999 and 0.531 out of five, respectively. Study found that there was a positive correlation between previous high achievement in mathematics and favourable attitude towards it.

Purbonongsih and Vionita (2017) conducted a classroom action research for Improving the Attitude Towards Mathematics Learning with problem posing approach in Class VIII . The sample of research was all of the students of grade VIII which consist of 32 students. This research had been held on two periods, first period being about 3 times meeting, and second period about 4 times meeting. The instrument of this research was the learning observation's guidance using problem posing approach. Alternative test had been used to measure cognitive competence, and questionnaire was also used to measure the students' behaviour in mathematics learning process. The result of research revealed that the students' behaviour has been improving after using problem posing approach. It was showed by the behaviour's criteria of students that had increasing result from the average in first period to high in second period. Furthermore, the percentage of test result was also improved from 68.75 percentage in first period to 78,13 percentage in second period. On the other hand, the implementation of learning observation by using problem posing approach has also improved teachers' achievement and it showed by the average percentage of teacher's achievement in first period is 89.2 percentage and student's achievement 85.8 percentage. These results got an increase in second period for both teacher and students' achievement which are 94.4 percentage and 91.11 percentage. According to the results, it was found that the students' behavior towards mathematics learning process in class VIII had been improving by using problem posing approach.

Tisiatsos, Katmada and Mavridis (2017) examined the effects of use of an on-line flexible educational game on students' attitude towards mathematics as compared to the conventional method of solving mathematical problems. The study assessed the learning effectiveness of the game and investigated potential gender differences in the game's effectiveness on changing students' attitude. The participants of the study were 79 students who were randomly assigned to a control and treatment group. The game was configurable and it was used as a supplementary teaching method. The intervention implemented 14 weeks and the data collection was based on quantitative measures and interviews. The results of the study indicated that the game approach was effective on improving students' attitude towards mathematics and that it also resulted in better learning outcomes in the treatment group as compared to that of the control group. Also, it was revealed that the gender of the students did not influence the positive effect of the game on students' attitude. The study suggests that the incorporation of flexible games into the traditional teaching of mathematics could possibly bring beneficial effects in learning.

Veliappan and Muthulakshmi (2015) investigated the efficacy of an interactive multi-media learning package for developing the attitude towards Mathematics. After establishing the homogeneity associated to the students' quarterly examination marks in Mathematics and the scores of the intelligence test, they were divided into 21 learners in control group and 21 in experimental group. The selected topics from the 9th standard Mathematics text book was taught through conventional method to the sample selected for the control group whereas, experimental group was given treatment through Interactive Multimedia Learning Package developed by the investigator. The Inventory if Attitude towards mathematics developed by the investigator was used to collect the data. Pre-test and post-test were implemented to both groups before and after the treatment. The results revealed that, a significant difference exists in the post test scores between the control and experimental groups associated to the attitude towards mathematics.

Hurst and Cook (2014) in a study reported on a part of on-going research into mathematics anxiety and competence of pre-service teachers. It uses two small samples of pre-service teachers from different cohorts of a Bachelor of Education course and attempted to identify factors that may help develop positive attitude towards mathematics as they seek to develop their competency in mathematics. The study identified that targeted professional learning and social constructivist teaching were the key factors as well as the need to identify personal knowledge of mathematics as a prelude to seeking to become a competent teacher.

Luliana (2013) conducted a study among pre-service primary school teachers' problem solving skills and their attitude towards mathematics. Students, who like Mathematics, who like to explain their solution to others and who don't like to solve more problems of the same type, have higher problem solving skills. The results show the necessity of developing a positive attitude towards Mathematics among pre-service primary school teachers. Also, it is important to use teaching methods, which encourage collaboration, put the student in the situation of explaining his/her solution, and require creativity from students.

Raju and Babu (2013) examined student teachers' attitude towards their profession in Vizianagaram district of Andhra Pradesh. The study was conducted on a sample of 437 student teachers among them 239 were male and 198 females. Methodology wise, 143 were Mathematics, 48 Physical Sciences, 134 Biological Sciences and 112 were Social Studies subject. The data was collected through Teacher attitude scale. The collected data were analysed with mean, standard deviation, and t-values for testing various hypotheses framed. The study found that significant difference exists in attitude with respect to gender and the subjects of study.

Kuranchie, Okyere and Mensah (2013) studied the role of attitude in learning of Mathematics. The study was fashioned to extend the discussion to the influence of teacher attitude on student attitude. The samples for the study were one hundred students and four Mathematics teachers making a total of one hundred and four respondents. The students were randomly selected while the teachers were purposively sampled. Two sets of questionnaires were used to gather data from the respondents after they had been validated and their reliability established. Students' end of term examination scores were used as a measure of academic achievement.

The study unveiled a significant relationship between teacher attitude and student attitude toward Mathematics. It was also realised that teachers' positive attitude radiated confidence in students; hence it made them to develop a positive attitude towards the learning of Mathematics. The results of the study were also consistent with existing findings on the relationship between teacher attitude and students' performance in Mathematics.

Akkaya and Memnun (2012) examined the attitude towards mathematics of elementary school pre-service teachers. The study investigated the differences in attitude among gender, grades and teaching fields. A total of 456 pre-service teachers, who were studying in the Education Faculty of AbantİIzzet Baysal University in Turkey, including 141 mathematics, 163 science and 152 elementary school pre-service teachers participated in the research. In conclusion, it has been understood that majority of the pre-service teachers have high level of positive attitude towards mathematics, but some pre-service teachers' attitudes need to be developed. There is a significant difference between attitude towards mathematics of sophomores and senior pre-service teachers and there is no significant difference between female and male pre-service teachers in relation to their attitudes towards mathematics.

Shah and Farook (2008) conducted a study regarding students' success in mathematics depends upon attitude towards mathematics. This study was based on a survey of high school students about their attitude towards mathematics. 685 students was selected for the sample of the study with 379 male and 306 female from 10th grade standard conveniently selected from 10 schools belongs to both private and public sector area. To examine the attitude of male and female students towards mathematics at secondary school level ,a questionnaire was used to collect the required data. Study concluded that there is no significant difference between male and female students in attitude towards mathematics and success in mathematics creates positive attitude towards mathematics.

Teaching performance

Floherty and Corcoran (2018) studied about the predictive factors of teaching performance among 400 pre-service teacher trainees. Pre-service teachers' prior teaching performance, personality characteristics and previous academic achievement were assessed as predictive factors of teacher performance. Results indicate that there was no significant relationship was identified between personality traits and the teaching performance . Also the study revealed that previous teaching performance in addition to academic achievement scores emerged as significant predictors of teaching performance.

Tammi, Koski and Santhi (2018) conducted a study about teaching, whether it is a practical or research-based. This study analyses teacher training in Finland from the teacher candidate's perspective. Cluster analysis divided the respondents into five groups, and each cluster had a short textual description. Qualitative data were included in the summary. Study identified that teacher students are not always able to connect the theoretical parts of their studies with practice. It indicates that Finnish teacher education has to resolve the demanding relationship between theory and practice.

Kalogeria & Psycharis (2017) explored the process of becoming a teacher educator in the pedagogical use of digital access in mathematics teaching. The study took place in the context of an in-service program during the trainees' engagement in their practicum fieldwork activities including the process observation, reflection, design, implementation and reflection. The features of this context that facilitated the trainees' transition from the level of student teachers to the level of teacher educator as well as the nature of the teacher trainees' documentation work for teachers.

Abas (2016) signified the field-based observation as a central part of pre-service teacher education and crucial for implementing effective practicum of pre-service teachers. He studied the perspectives of graduating pre-service teachers regarding their difficulties related to administrative support, co-operating teachers, student supervisors, students, peers, assigned tasks and learning environment during their 17-hour field observation in selected private and public secondary schools. An explanatory sequential mixed-methods research design was adopted utilizing survey questionnaire, Focus Group Interviews, and Key Informant Interview. Quantitative data were obtained from 136 respondents selected through stratified random sampling using proportionate allocation while qualitative data were gathered from 10 pre-service teachers, 10 co-operating teachers, six student supervisors and two school principals who were chosen purposively. Results of descriptive statistical analysis served as basis for the design of qualitative interview and focus group schedules which helped the researcher to "explain, or elaborate on the quantitative results". Findings of the study showed that pre-service teachers had over-all moderate difficulties during the field observation particularly on students, assigned tasks and learning environment.

Piromsombat, Wongwanich and Suknaisith (2014) conducted a study to develop teacher performance in educational measurements and evaluations through self-monitoring strategies. Participants consists of 10 administrators and teachers. Qualitative data was collected from informal interview schedule and a focus group. The research was conducted in five steps for improving self-monitoring. The results of this study revealed that the self-monitoring strategies reveal that teachers learnt best from the concrete example in the report on test planning and preparation for the Basic Education National test.

Hamid, Hassan and Ismail (2012) explored a teacher effectiveness model. This model measured the teacher's cognitive ability (skills of assessment and evaluation, IT skills, and co-curricular knowledge) and the teacher's personality or interpersonal skills. The respondents were 2000 experienced teachers working in Malaysia from different types of schools. Using structural equation model (SEM), this study attempted to ascertain the validity of the structural model in which the teacher's cognitive abilities and personalities predict teacher's performances. The results found that a model is suitable to both cognitive abilities and personality predicting classroom management. Good personality alone is insufficient in terms of enhancing the teachers' commitment, behavior and responsibilities

Maputol (2010) conducted a study to assesses the results of the hiring tests given by the Ateneo de Davao High School to its teacher aspirants with their teaching performance while hired. Data were collected according to: probationary teachers; teachers with education degree; teachers with non-education degree; male probationary teachers and; female probationary teachers. The findings reveal that teacher-candidates who are education graduates can perform better than non-education graduates. The next studies may examine the correlates of results of interviews and teaching demonstration on the candidates teaching performance when hired.

Kogce, Yildiz, Bak and Aydin (2005) studied the mathematics teacher educators' beliefs about teacher role in teaching mathematics. Case study was conducted as research method. An interview form developed by the researcher, composed of open-ended and scenario type questions was used as the data collecting tool. Interviews taking average 60 minutes were carried out with five academicians from Karadeniz Technical University (KTU) during 2006-2007 academic year. Study found that the participants' beliefs about teacher role fairly comply with the philosophical viewpoints of the new mathematics curriculum in Turkey.

Hill (2000) conducted a case study investigating the impact of a primary mathematics method programme on pre-service primary teachers' capacity, and willingness to learn and teach mathematics for relational understanding. The programme, a collaborative endeavour between primary schools and university tutors, enables student teachers to practice in an on-going, integrated and consistent manner what they are learning in theory, and to reflect on their experiences. The findings from the questionnaire and interview data indicate that the weekly cycle of theory, practice and reflection in which student teachers engage enhances their capacity, and provides an incentive for them to learn and teach mathematics for relational understanding.

Self-learning Module

Halomoan, Dewi and Andriyani (2018) conducted a study to find out the quality of lectures on mathematics learning strategy in Mathematics Department. They developed a learning module of mathematics learning strategy based on Higher Order Thinking Skill (HOTS) that can be used to improve mathematical communication and self efficacy of mathematics education students. The prototype module was experimented among 10 students as try out in the first phase and administered on 31 Semester V students of mathematics education. The results of the study indicated the module as good and effective among the large group and have a good legibility value among the small group for their self efficacy.

Shamina (2018) developed and validated a classroom management competency enhancement programme for prospective teachers at secondary level. The investigator developed a classroom management competency enhanced programme (CMCEP) and found that the effect of this package was significant to improve the classroom management skills in managing instruction, maintaining discipline and establishing inter personal relationship in the classroom activities.

Venkitesh, Savitha, Nagarajan and Devi (2018) studied the effectiveness of a self-learning module in phonetic transcription of Tamil language for students of speech-language pathology. A self-learning module with information on phonetic transcription and sounds of Tamil was developed. Exercises for practicing transcription at the word and phrase levels were included in the module. Fifty undergraduate students of Audiology and Speech-Language Pathology (ASLP), with limited exposure to phonetic transcription, completed the self-learning module individually. The efficacy of the self-learning module was evaluated through a questionnaire, and a phonetic transcription task aimed at assessing the knowledge and skill of transcription. The participants completed the questionnaire and transcription task prior to and after completion of the self-learning module. The findings indicated that post-learning scores on the questionnaire and phonetic transcription task were significantly higher than pre-learning scores suggesting improvement in knowledge and skill of transcription upon completion of the self-learning module. They also found that the self-learning module is an acceptable and effective method for learning phonetic transcription by undergraduate students of ASLP.

Hurst (2016) investigated the systematic and effective training of teachers by the use of inquiry techniques among sixty teacher educators. Flexible competency-based learning modules were designed to change the elementary teacher trainees' knowledge-skills in and attitude through inquiry teaching. The effectiveness of the modules was compared in three classroom settings: individualized, group, and control. The results were 1. There was a significant increase in the achievement of students in both treatment groups ; 2. Significant gains in the treatment on attitude towards inquiry teaching, 3. A significant decrease in treatment preference for a directive teaching style, and 4. No significant differences between students' knowledge, attitudes, and preferences in the two treatment groups.

Jhonson and Celik (2015) explored pre-service teachers' perceptions of movement education, the benefits they perceive from participating in a 12-week movement education module in a course on play, and the module's effects on their confidence and competence with regard to incorporating movement into a curriculum. Findings reveal that the pre-service teachers achieved a deeper understanding of movement education and appreciated the module as a worthwhile professional growth experience. Specifically, they viewed the module as enabling them to build a new understanding of movement, to express themselves physically, to develop movement skills, to engage in social interactions, and to teach a variety of subjects using movement education principles. The study demonstrated that the module of this nature constitutes a useful educational tool for fostering the professional development of pre service teachers with regard to their beliefs, attitudes, and skills pertaining to movement education.

Jayanthi (2014) conducted a study that intend to find out the effectiveness of Teaching Competency based Self-instructional Module of Giftedness. The prospective teachers (35) who possess low level of knowledge on giftedness was given with the Teaching competency based self-instructional module on giftedness and investigator served as a facilitator. After a period of self-study their knowledge and teaching competency at pre and post stage was assessed. The study evidenced the need to provide training on giftedness to handle children with diverse needs

Albayrak and Unal (2011) in a quantitative study investigated the effect of methods of teaching mathematics course on the elementary pre-service mathematics teachers' mathematics teaching efficacy beliefs in Turkey. Mathematics Teaching

Efficacy Belief Instrument was administered to 172 junior elementary mathematics education students as pre-test and post-test prior to and after the methods of teaching mathematics course. The course was carried out through demonstrations, direct instructions and classroom discussions during 14 weeks. Paired sample t-tests were used to analyze the data and indicated that the methods of teaching mathematics course significantly increased the pre-service teachers' mathematics teaching efficacy beliefs.

Yusof (2010) conducted a study in connection with the development and design of a new alternative approach to teaching, which is referred to as a hybrid teaching approach. This teaching approach was developed to meet the challenges and academic needs of students learning technical subjects at polytechnic level in Malaysia. It was intended to help students improve their learning and deepen their understanding in learning the subjects matters. The HybCoMet Instructional Module was designed as an alternative to the current teaching approaches which are hereinafter referred as traditional approaches. The strategy is intended to help students to learn in a meaningful way, by facilitating the assimilation of their knowledge prior to transfer it into real world situation. The purpose of the teaching module of HybCoMet Strategy was to encourage teachers to move away from the current teaching approach by which students are facts and information. The strategy could be beneficial for teachers preparing a lesson and was more effective at pointing teachers toward individual learning objectives. The designed instructional module was helpful to contribute as a new pedagogical approach to the representation of hybrid system for technical education needs at the polytechnics level and supply as a comprehensive academic references.

Nath (1998) developed a self-instructional module for the secondary school biology teachers for their in-service training. The sample selected was 178 biology teachers and he identified that such an instructional package is very useful to cater the knowledge and to create positive attitude towards the subject.

Conclusion

The investigator reviewed studies with special focus on the selected area of the study viz., Mathematics Content Knowledge, Attitude towards Mathematics, teaching Performance and Self- Learning Module. An analysis of the studies in the area of teacher education made the investigator to arrive at a conclusion that it is relevant to study the mathematics content knowledge and pedagogical knowledge of prospective teachers. Generally the studies in the area of MCK reveal that pre-service teacher candidates are having insufficient content knowledge in mathematics.

The studies related to Attitude towards Mathematics are no way different from that of the MCK. Most of the studies highlighted the observation that positive attitude of the teacher directly influences the attitude of students. The knowledge and awareness with regard to the basics of the subject is a determinant factor in deciding and influencing the attitude towards mathematics. Some of the studies reached into a conclusion that improvised and innovative strategies play an accelerating role to develop a positive attitude towards mathematics. Certain studies focused on the very process of assessing and ascertaining the attitude of prospective teachers as well as secondary school students towards mathematics.

The number of studies with special focus on teaching performance is relatively low. The studies identified in this area paid special attention to the predictive factors, previous learning experience, scope of collaborative learning, reflective classroom practices, role of theory as well as practice and methodology and strategies of teaching in the creation of performance in teaching.

The investigator as a part of the review could come across with certain studies in which the investigators attempted to develop certain self-learning module in order to enhance and support the teaching performance. Irrespective of the size of the group, it was found that the self-learning module could evolve significant and positive changes among the students.

In this context, the investigator hope that the development of a self-learning module is quite relevant and it is highly required to boost up the confidence level and performance level among the target group in the context of teaching of mathematics. Moreover, the investigator wished to take an attempt to examine the effectiveness of the module in fostering performance in teaching mathematics among prospective teachers at primary level.

Chapter 3

METHODOLOGY

- Design of the study
- Variables
- Objectives
- Participants of the study
- Instruments used for the study
- Data collection procedure
- Statistical techniques used

An account of the methodology of the present study is given in this chapter. Methodology is the vital part of any research, as it guides the way to proceed. The selection and application of suitable methods, procedures and techniques comes under the purview of methodology. The present study is meant for developing a Self-Learning Module (SLM) in Mathematics for the prospective teachers to enhance performance in teaching mathematics. Methodology followed in the study is described under the major headings viz.,

Design of the study

Variables

Objectives

Participants of the study

Instruments used for the study

Data collection procedure

Statistical techniques used

Design of the Study

Present study focuses on the construction of a Self Learning Module (SLM) and its validation. As an initial step a survey was done to know the extent of Mathematics Content Knowledge and the nature of Attitude towards Mathematics among D.Ed students. The constructed module was given to teacher educators of various teacher training institutes and their ratings and comments on various aspects of the module were consolidated.

For finding out the effectiveness of the constructed SLM in improving the performance in teaching mathematics, Quasi-experimental design was used. The design can be represented as

Experimental	**O1**	**x**	**O2**
Control	**O3**		**O4**

Figure 1: Diagrammatic representation of the experimental design (Cohen, Manion, & Morrison, 2007)

The dashed line separating the parallel rows in the diagram indicates that the experimental and control groups have not been equated by randomization. Thus the design selected for the study is the pre test-post test non-equivalent group design.

In the present study, two intact groups of students of DIET, Palakkad and DIET, Malappuram districts of Kerala State were assigned as the experimental and control groups respectively. Pre-tests on basic Mathematics, Attitude towards Mathematics and Mathematics Aptitude were administered among both experimental and control groups. Then the experimental group was provided with the SLM, which is the treatment, whereas control group was not exposed to the treatment.

On completion of the SLM by the prospective teachers in the experimental group, post-tests on basic mathematics and Attitude towards mathematics were administered for both groups. During their internship programme, teaching performance of both experimental and control groups was assessed by the investigator through observation. The treatments given to the experimental and control groups are presented as Figure 2 and Figure 3.

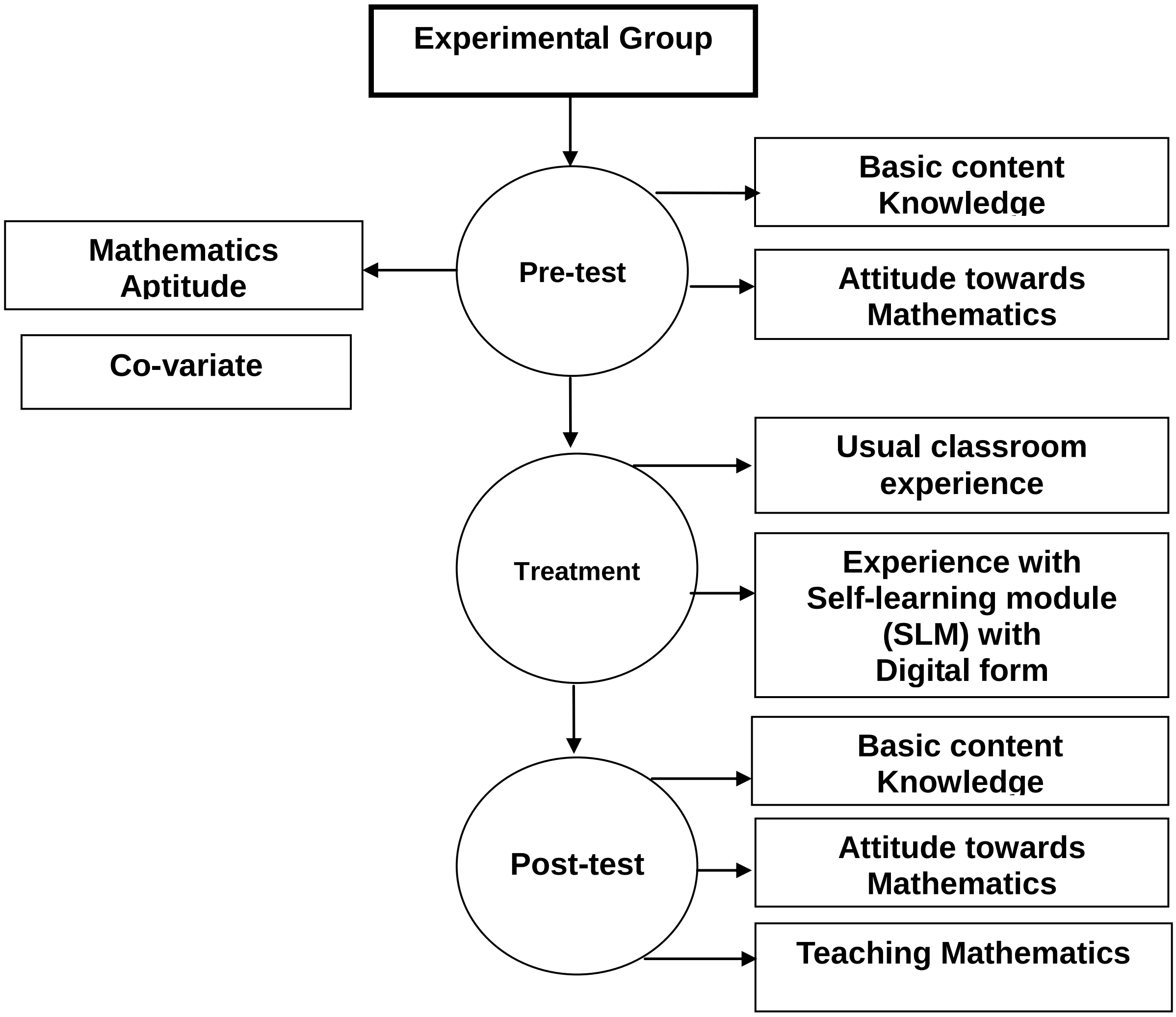


Figure 2: Flowchart on experimentation (Experimental Group)

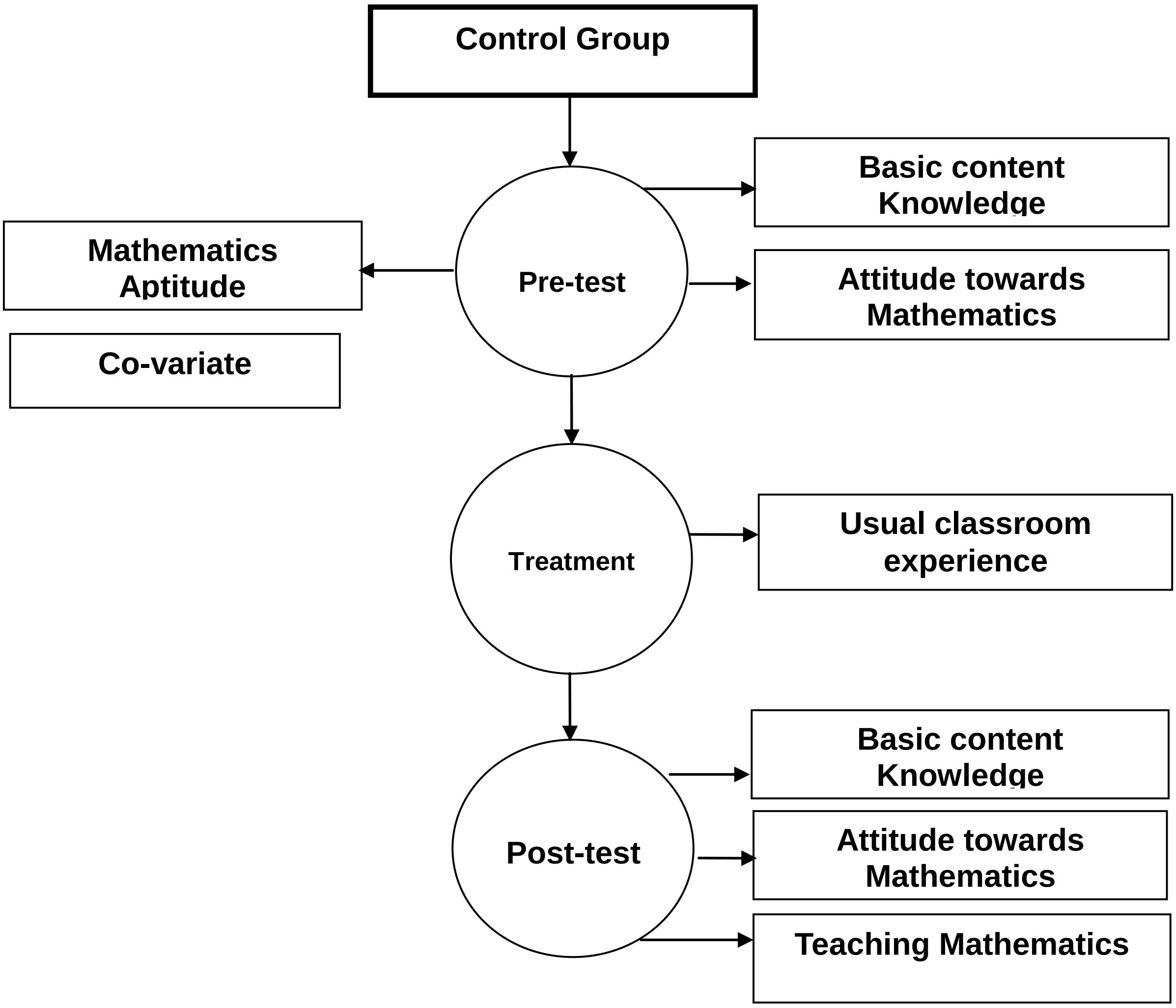


Figure 3: Flowchart on Experimentation (Control Group)

Variables

Variables can be defined as the conditions or characteristics in which the experimenter manipulates, controls, or observes. In this study, there are two types of variables, viz., dependent and independent variables. Independent variables can be defined as the conditions or characteristics in which the experimenter manipulates or controls in her or his attempt to ascertain their relationship to the observed phenomena. The dependent variables are –"the conditions or characteristics that appear, disappear or change as the experimenter introduces, removes or changes independent variables” (Best & Kahn, 1996).

In an experiment, the treatment variables are the independent variables that the researcher manipulates in order to determine their effect on the dependent variables. A treatment variable has at least two levels, or categories. In the present study the treatment variable is the type of training for D.Ed students with two levels as implementation of the developed SLM on Mathematics together with the usual D.Ed programme for the experimental group and the usual D.Ed programme without the SLM for the control group. Teaching performance is a combination of cognitive, affective and skill parts and content knowledge, attitudes and teaching skills are the components of teaching performance (Gage, 1963). Thus the dependent variables in the present study are mathematics content knowledge, attitude towards mathematics and teaching mathematics which altogether is termed as performance in teaching mathematics.

In an experiment, there will be some variables that co-vary with dependent variable, but not related to the independent variable. These variables are the co-variates which can be controlled statistically. In the present study, the investigator has taken mathematics aptitude as the co-variate.

Mathematics aptitude is the basic ability to learn mathematics and it will surely determine the outcome variable, performance in teaching mathematics which includes mathematics content knowledge, attitude towards mathematics and teaching mathematics. It is not practicable to control mathematics aptitude physically, but its influence can be controlled statistically by using ANCOVA.

Objectives of the Study

The major objective of the study is to develop a self-learning module (SLM) that is capable of enhancing the performance in teaching mathematics of prospective teachers at primary level.

The minor objectives set for the study are related to the establishment of need of such a module and its effectiveness to bring changes in Mathematics content Knowledge, Attitude towards Mathematics and Teaching Mathematics of prospective teachers. The following are the minor objectives set for the study.

1. To find out the extent of

   a) Mathematics Content Knowledge

   b) Attitude towards Mathematics

   c) Mathematics Aptitude among prospective teachers at primary level.

2. To compare the pre-test mean scores between control and experimental groups on

   a) Mathematics Content Knowledge

   b) Attitude towards Mathematics

   c) Mathematics Aptitude

3. To compare the pre-test and post-test mean scores of prospective teachers of both control and experimental groups on

   a) Mathematics Content Knowledge

   b) Attitude towards Mathematics

4. To compare the Post- test mean scores of prospective teachers of control and experimental groups on

   a) Mathematics Content Knowledge

   b) Attitude towards Mathematics .

5. To compare the mean gain scores of prospective teachers of control and experimental groups on

   a) Mathematics Content Knowledge

   b) Attitude towards Mathematics

6. To compare the mean score on Teaching Mathematics of prospective teachers of control and experimental groups

7. To test the influence of SLM on

   a) Mathematics Content Knowledge

   b) Attitude towards Mathematics

   c) The scores on Teaching Mathematics of prospective teachers when Mathematics Aptitude is taken as a co-variate..

8. To find out the effect size of the developed self-learning module on Mathematics Content Knowledge, Attitude towards Mathematics and the score on Teaching Mathematics of prospective teachers at primary level

Participants

In order to know the level of MCK and Attitude towards mathematics as well as to find out the weakest content area, a survey was conducted on a sample of 100 D.Ed students selected using stratified sampling technique from four districts of Kerala state, viz., Thrissur, Palakkad, Malappuram and Kozhikode, the strata being considered as the locale and type of management. The sample was selected from the central part of Kerala state, because a wide sample cannot be covered within the time limit as the data is to be collected in the first week after admission to the D.Ed. course. The details of the sample are given as Appendix A.

The developed module is intended to enhance performance in teaching Mathematics of prospective teachers at primary level in Kerala. Hence the module was validated by applying it to an intact group of 40 prospective teachers at primary level of DIET Palakkad treated as the experimental group who used the SLM together with the regular pre-service teacher education programme and 40 prospective teachers from DIET Malappuram as control group who have undergone regular pre-service teacher education programme at primary level. Details of the participants included in the experiment are given as Figure 4.

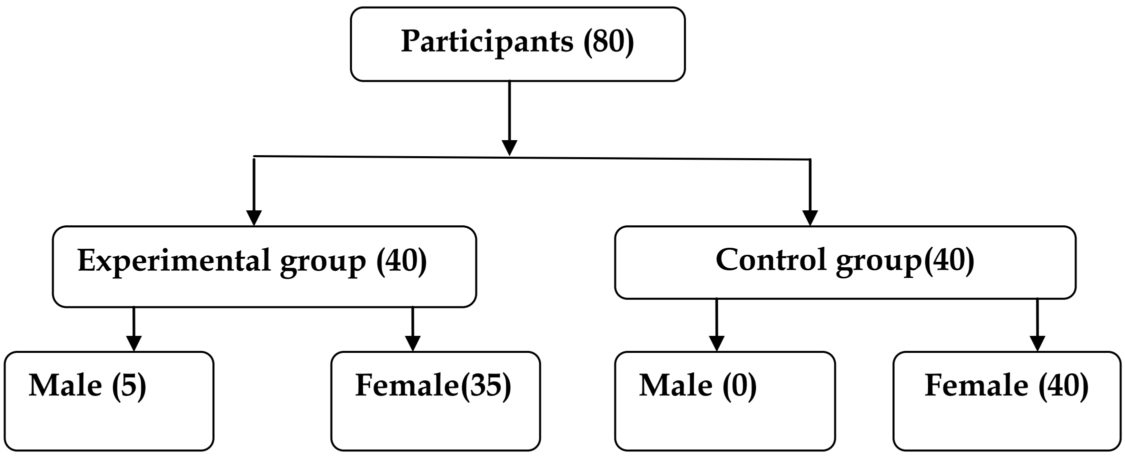


Figure 4: Details of Participants of the study

In order to get rated on different aspects of the developed module, a rating scale was administered on a sample of 16 teacher educators of 9 institutes, one DIET and 8 Teacher Education Institutions.

Thus the participants of the study include 100 prospective teachers for survey, 80 for experiment (among which 40 belong to control group and 40 to experimental group) and 16 teacher educators.

Instruments used for the study

Following instruments were used for the study:

1. Scale of attitude towards Mathematics. (Saheedali &Vijayakumari, 2013)
2. Test of Mathematics Aptitude (Malini &Sumangala, 1996)
3. Test on Mathematics content Knowledge at primary level (Saheedali &Vijayakumari, 2013)
4. Observation Schedule for assessing teaching performance of prospective teachers
5. Self-learning module in Mathematics.
6. Rating scale to rate different aspects of the module

Each instrument is described below.

Scale of Attitude towards Mathematics

To measure attitude towards mathematics of the prospective teachers, the investigator along with the supervising teacher developed a scale on Attitude towards mathematics. This tool is a five-point Likert-type attitude scale, having positive and negative statements. After reviewing the studies related to attitude towards mathematics, the investigator identified eight dimensions of Attitude towards Mathematics which are given below.

1. Value of learning Mathematics
2. Practicality of Mathematics in life
3. Anxiety and motivation in Mathematics
4. Attitude towards teachers of Mathematics
5. Use of Mathematics to learn other subjects.
6. Attitude towards Mathematicians
7. Universalisation of Mathematics
8. Aesthetics of Mathematics

Value of learning mathematics

Mathematics is regarded as the mother of all sciences. If students are to function effectively in this era of rapid technological advancement and globalization, they must be mathematically literate. Those who understand and can do mathematics have significantly enhanced opportunities and options that will open doors to productivity.

The Kothari Commission (1964-66) emphasized the significance of mathematics in the school curriculum by stating

> One of the outstanding characteristics of scientific culture is quantification. The advent of automation and cybernetics, in this century, marks the beginning of the scientific industrial revolution and makes it all the more imperative to devote special attention to the study of mathematics. Proper foundation to the knowledge of the subject should be laid in the school.

In the words of Young (1971)

Mathematics is the only subject that encourages and develops logical thinking. It enables the student to discriminate between essential and non-essentials. It helps them to sift facts, to draw conclusions tersely and without ambiguity and that is the subject by which they may learn what is meant by rigid reasoning.

Therefore, Knowledge of mathematics is very essential for training rational, trust worthy and useful citizens in a democratic society.

So, the investigator has included the above area in the scale.

Example: ഗണിതശാസ്ത്രം പഠിച്ചവർക്ക്ജോലി നേടാൻ എളുപ്പമാണ്

(Mathematics learning helps in earning a job).

Practicality of mathematics in life

Mathematics is a subject which plays a vital role in every ones life. It has many practical applications and is needed at every stage of life. People can get along even without their mother tongue but not without mathematical calculations. A person belonging to any class of society whether wealthy or poor, has to use the knowledge of mathematics in one form or the other. Hence attitude on this aspect was also included in the scale.

Example: നിത്യജീവിതത്തിൽ പ്രയോജനപ്പെടുമെന്നുള്ളത് കൊ ാണ് ഞാൻ കണക്ക് പഠിക്കുന്നത്. (I learn Mathematics because of its Practical value).

Anxiety and motivation in mathematics

Mathematics anxiety and motivation are two important student related factors that affect learning of mathematics. Mathematics anxiety is a negative feeling to mathematics learning process. It is a feeling of tension, apprehension, or fear that interfere mathematics performance. Motivation in Mathematics is positive factor that makes the learner work hard to achieve the goals.

Example: കണക്ക്പഠിക്കാൻ എനിക്ക് താല്പര്യമാണ്

(I am interested in learning Mathematics).

Attitude towards teacher of Mathematics

Attitude towards Mathematics teachers is a part of Attitude towards Mathematics and hence is included as a component in the scale.

Example: ഗണിതശാസ്ത്ര അദ്ധ്യാപകർ ശ്രേഷ്ഠരാണ്

(Mathematics teachers are great persons).

Use of Mathematics to learn other subjects

After understanding the basic concept of mathematics, students need to correlate the important concepts of mathematics with other subjects, so as to understand other subjects easily and establish relationship. Mathematical knowledge plays a crucial role in understanding the contents of other subjects. Thus, this area is included in the scale.

Example: മറ്റുവിഷയങ്ങൾ പഠിക്കുവാൻ ഗണിതം സഹായിക്കുന്നു

(Mathematics helps to learn other subjects).

Attitude towards Mathematicians

Attitude towards mathematicians is positively correlated with the attitude towards the subject. So, this component is included in the scale.

Example: ഗണിതശാസ്ത്രജ്ഞരുടെ ജീവചരിത്രം ഗണിതം പഠിക്കുവാൻ കുട്ടിക

ളിൽ അഭിപ്രേരണയു ാക്കുന്നു.

(Biography of Mathematicians brings motivation to learn mathematics among pupils)

Initially 63 statements based on the above dimensions were written by the investigator. These items were undergone scrutiny by the supervising teacher and other experts in the field. The items of the scale were edited as per the correction suggested by the experts resulting in a draft scale of 40 items among which 12 are negatively stated and 28 are positively stated. Then conducted a try-out among 12 prospective teachers and modified the items according to their opinion and difficulty to understand the item. The draft scale is given as Appendix B.

Pilot testing

The draft scale was administered on a sample of 200 prospective teachers from four institutes of teacher education. The sample was selected using stratified sampling technique in which type of management and locality of the institutes was considered. While administering the tool, proper instruction was given about the procedure of responding to the items and after completion of responding by the prospective teachers, response sheets were collected back and scored according to the scoring procedure.

Item analysis

The response sheets were arranged in the order of magnitude and upper 27 percentage and lower 27 percentage were separated as high and low group respectively. Mean and standard deviation for each item was calculated and critical ratio for each item was estimated for testing the significance of mean difference between the two groups for each item.

Items with t-value greater than 1.96 were selected for the final scale. Table 1 contains details of the item analysis for the scale of Attitude towards Mathematics.

Table 1

Mean, S.D and t- value of items of Scale of Attitude towards Mathematics

Item	Group	N	Mean	SD	t- value	Item	Group	N	Mean	SD	t- value
1	Low	54	4.59	.507	3.67*	21	Low	53	4.02	1.065	2.543*
	High	54	4.91	.392			High	54	4.48	.795	
2	Low	54	4.46	.539	0.19	22	Low	54	4.33	.801	3.134*
	High	54	4.44	.502			High	54	4.74	.521	
3	Low	54	4.50	.505	1.22	23	Low	54	4.09	.957	3.455*
	High	54	4.63	.592			High	54	4.63	.623	
4	Low	54	4.29	.843	2.204*	24	Low	54	4.35	.955	2.038*
	High	54	4.59	.538			High	54	4.67	.614	
5	Low	54	4.33	.932	2.44*	25	Low	54	4.39	.878	1.149
	High	54	4.69	.507			High	54	4.56	.604	
6	Low	54	4.22	1.058	1.09	26	Low	54	4.28	.920	2.364*
	High	54	4.41	.659			High	54	4.63	.592	
7	Low	54	4.30	.838	2.40*	27	Low	54	4.19	.870	2.364*
	High	54	4.65	.677			High	54	4.56	.604	
8	Low	54	4.39	.787	0.38	28	Low	54	4.17	1.077	2.569*
	High	54	4.44	.718			High	54	4.65	.705	
9	Low	54	4.17	.863	4.59*	29	Low	54	4.26	.873	2.533*
	High	54	4.78	.462			High	54	4.61	.529	
10	Low	54	4.21	.930	2.24*	30	Low	54	4.41	.790	2.809*
	High	54	4.56	.665			High	54	4.76	.473	
11	Low	54	3.94	1.054	5.048*	31	Low	54	4.31	.865	2.073*
	High	54	4.74	.483			High	54	4.61	.596	
12	Low	54	3.96	1.243	3.251*	32	Low	54	4.35	.935	2.671*
	High	54	4.57	.602			High	54	4.74	.521	
13	Low	54	4.06	.940	4.400*	33	Low	54	4.28	.811	2.93*
	High	54	4.70	.537			High	54	4.56	.746	
14	Low	54	4.28	.920	2.990*	34	Low	54	4.39	.763	2.170*
	High	54	4.70	.500			High	54	4.68	.619	
15	Low	54	3.89	1.160	3.811*	35	Low	54	4.61	.627	.325
	High	54	4.57	.633			High	54	4.65	.555	
16	Low	54	3.96	1.149	4.398*	36	Low	54	4.43	.716	.957
	High	54	4.70	.461			High	54	4.56	.691	
17	Low	54	3.87	1.150	4.139*	37	Low	54	4.48	.771	2.368*
	High	54	4.59	.567			High	54	4.78	.502	
18	Low	54	4.19	.992	2.705*	38	Low	54	4.55	.588	3.07*
	High	54	4.61	.596			High	54	4.86	.451	
19	Low	54	4.07	1.079	2.935*	39	Low	54	4.69	.469	2.075*
	High	54	4.56	.538			High	54	4.85	.359	
20	Low	54	4.19	.992	2.308*	40	Low	54	4.83	.376	.830
	High	54	4.52	.746			High	54	4.89	.317	

** denotes items selected for the final scale.*

Rejecting items with critical ratio less than 1.96 resulted in a final scale of 32 items. There are 9 items which are negatively worded and 23 items positively worded. The final scale is appended as Appendix C.

Scoring Procedure

Each statement in the scale has five possible responses viz., Strongly Agree, Agree, Undecided, Disagree and Strongly Disagree. The responses to each item has to be scored as 5, 4, 3, 2, and 1 respectively for responses Strongly Agree, Agree, Undecided, Disagree and Strongly Disagree for a positively stated item. The scoring is in the reverse order for a negative statement. The total score for an individual stands for his score on Attitude towards Mathematics. Thus, the maximum score on the scale is 160 and minimum is 32.

Reliability

Reliability coefficient of the scale was ensured by calculating Cronbach alpha coefficient. Cronbach alpha coefficient obtained is 0.78. The test-retest method was also used for finding the reliability of the scale. The developed scale was administered on a sample of 30 students for the first time and the same scale was administered after three weeks to the same students. The correlation coefficient was calculated for the two sets of scores. The obtained value is .887. Thus the instrument can be considered as a reliable one.

Validity

The scale has face validity as these items seem to measure attitude towards mathematics. The criterion related validity was also ensured empirically by correlating the scores on the developed scale on Attitude towards Mathematics with the scores on the scale of Attitude towards Mathematics developed by Sumangala and Sunny (1987). For this, both the scales were administered on a sample of 30 D.Ed students. After scoring the responses, correlation between the two sets of scores was calculated. The Correlation coefficient obtained is 0.84. Hence the scale is valid to measure Attitude towards Mathematics.

Test of Mathematics Aptitude (Sumangala & Malini, 1996)

This test is used to measure Mathematics Aptitude of Prospective teachers. The test includes five sub tests on Numerical Aptitude, Numerical Reasoning, Ability to use symbols, Spatial ability and Abstract Reasoning. The details are given as Table 2.

Table 2

Components of test of Mathematics Aptitude

Sl.No	Name of Sub Test	Number of questions	Allotted time(Minutes)
1	Numerical Aptitude	25	25
2	Numerical Reasoning	12	10
3	Ability to use symbols	5	5
4	Spatial Ability	9	8
5	Abstract Reasoning	16	10
	Total	67	58

Each subtest of the test of Mathematics Aptitude is described below.

Test 1: Numerical Ability

The test of Numerical Ability is intended to measure the quickness and accuracy in simple arithmetic calculations. This part contains 25 items and takes 25 minutes to complete.

Example: (0.25+5) x5-0.05 =...........................

A. 0.15 **B**. 0.25 **C**.0.2 **D**.0.05

Test 2: Numerical (Mathematical) Reasoning

Test of Numerical (Mathematical) reasoning is intended to test the reasoning power of students in doing mathematical verbal problems. It includes clear understanding of the problems, processing the data mentally and then reaching at the solution. This part contains 12 items and allotted 10 minutes to complete.

Example: If X(X-Y)=0, then which of the following is the correct conclusion?

A.X=0 **B**.X=0 or Y=0 **C**.X=Y **D.**X=0 and Y=0

Test 3. Test of Ability to use symbols

Test of ability to use symbols is intended to test the ability of students in comprehending mathematical symbols with ease and accuracy. This part contains 5 items and takes 5 minutes to complete.

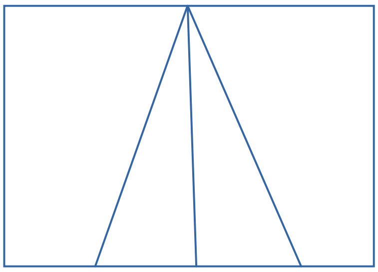
Example: If * denotes the division, **+** denotes multiplication, then

(18 * 6)+(24*2)+12=?

Test 4: Spatial Ability

The test of spatial ability measures the pupils ability to visualize geometric patterns in space and then arriving at the solutions. This part contains 9 items and is to be completed within 8 minutes.

Example: How many triangles are there in the following picture?



A.10 **B.**8 **C.**12 **D.**9

Test 5. Test of Abstract Reasoning

Test of Abstract Reasoning involves three types of test items, viz., analogy, series, and classification. Students have to use their reasoning rather than rote memory or associations. This sub-test contains 16 items and is to be answered within 10 minutes.

Example:

Scoring procedures

As all the items are of objective type, the scoring scheme is to give 1 score to the correct answer and 0 score for the incorrect answer. The maximum score obtainable for the test is 67 and the time allotted is 58 minutes.

Reliability

The test-retest reliability coefficient of the total test is 0.72 (N=40). Alpha Coefficient of reliability is 0.68 (N=100). Hence the test can be considered as a reliable one.

Validity

The criterion-related validity coefficient (against school score in Mathematics) is 0.65 which is established on a sample of 40 standard nine students. Hence the test is valid to measure Mathematics Aptitude of students.

A copy of the test is given as Appendix D.

Test on Mathematics Content Knowledge at primary level

The mathematics content knowledge of prospective teachers was measured through a test on basics of mathematics constructed in the format of an achievement test. The stages of development of the test are described below.

Planning

A test of 100 items on the basics of Arithmetic, Algebra and Geometry (upto 7^{th} standard) for one hour duration was planned for the purpose. Objective type questions are expected to be included in the test.

Designing

The content to be included was finalized by analyzing the mathematical portions of Kerala syllabus from standard 3 to standard 7. Then weightage to objectives, content, form of questions and difficulty level were fixed. The details are given in table 3 to Table 6.

Table 3

Weightage to objectives

Sl No	Objectives	Score	Percentage
1	Knowledge	27	27
2	Understanding	52	52
3	Application	21	21
	Total	100	100

Table 4

Weightage to Content

Sl.No	Content	Score	Percentage
1	Algebra	6	6
2	Arithmetic	66	66
3	Geometry	28	28
	Total	100	100

Table 5

Weightage to form of questions

Sl no	Type of Objective Questions	Number of questions	Score	Percentage
1	Multiple choice	94	94	94
2	Completion	06	06	06
	Total	100	100	100

Table 6

Weightage to Difficulty level

Sl No	Difficulty Level	Score	Percentage
1	Easy	11	11
2	Average	67	67
3	Difficult	22	22
	Total	100	100

Blue Print

A blue print was made based on the basis of design of the test which is given in the Table 7.

Table 7

Blueprint of the test on Mathematics Content Knowledge at primary level

Objectives	Knowledge		Understanding		Application		Grand Total	
Content	MC	C	MC	C	MC	C	MC	C
Algebra	1(2)		1(3)		1(1)		1(6)	
Arithmetic	1(16)		1(38)		1(12)		1(66)	
Geometry	1(5)	1(4)	1(9)	1(2)	1(8)		1(22)	1(6)
Total	1(23)	1(4)	1(50)	1(2)	1(21)		1(94)	1(6)
Grant Total	27		52		21		100	

(Note: **MC**: Multiple Choice , **C:** completion type, The Number outside the parenthesis indicates the score and the number inside it indicates the number of questions.

Writing the Items

The areas included are arithmetic, geometry and algebra. The topics included under Arithmetic are numbers, fractions, percentage, decimal numbers and ratio & proportion, geometry and algebra. As per the requirements in the blueprint, items were written. These items were undergone scrutiny by experts in Mathematics education and corrections were made as per their suggestions. These items were arranged in the order of difficulty. Multiple choice and completion type questions were included.

Try out

The draft test was administered on a sample of 110 prospective teachers selected through stratified sampling technique. After responding (duration of 1 hour) the response sheets were collected back and scored. For this, a correct answer was given 1 score and a wrong one zero. Total score for each response sheet was calculated.

Item Analysis

For the purpose of ensuring the quality of items, item analysis was done by calculating difficulty index and discrimination power. For this, the response sheets were arranged in the ascending order and the top 27 Percentage (30) and lower 27 percentage (30) were separated. Difficulty index and discriminating power of each item was calculated using the formulae,

$$Di = \frac{U+L}{2N}$$

$$Dp = \frac{U-L}{N}$$

Where U is the number of correct responses in the upper group, L is the number of correct responses in the lower group and N=30.

An item with low difficulty index is a difficult item and an item with high difficulty index is an easy one. Items with high discriminating power are better items. As per the design, 11 items are easy and 22 items are difficult. Items with difficulty index less than or equal to .45 was considered as difficult items and that above .6 as easy items. It was found that all the 100 items have discrimination power greater than .4. The details of item analysis are given in table 8.

Table 8

Difficulty index and Discrimination power of the items in the draft test

Item No.	U	L	DI	DP	Item No.	U	L	DI	DP	Item No.	U	L	DI	DP	Item No.	U	L	DI	DP
1*	28	9	0.62	0.63	26*	5	1	0.50	0.48	51*	15	12	0.58	0.57	76*	18	12	0.52	0.97
2*	26	5	0.52	0.7	27*	29	10	0.65	0.63	52*	28	6	0.57	0.73	77*	28	2	0.5	0.87
3*	29	5	0.57	0.8	28*	30	7	0.62	0.77	53*	28	2	0.5	0.87	78*	26	4	0.5	0.73
4*	25	10	0.58	0.5	29*	28	11	0.60	0.57	54*	26	4	0.5	0.73	79*	17	2	0.52	0.60
5*	26	9	0.58	0.57	30*	29	9	0.63	0.67	55*	26	5	0.52	0.7	80*	15	6	0.50	0.48
6*	27	4	0.52	0.77	31*	28	4	0.60	0.56	56*	28	2	0.5	0.87	81*	15	2	0.45	0.51
7*	18	1	0.32	0.57	32*	30	6	0.6	0.8	57*	26	4	0.5	0.73	82*	19	7	0.46	0.47
8*	26	4	0.5	0.73	33*	30	1	0.52	0.97	58*	20	7	0.52	0.60	83*	20	10	0.44	0.50
9*	27	4	0.53	0.8	34*	11	1	0.54	0.48	59*	28	2	0.5	0.87	84*	22	0	0.37	0.73
10*	15	12	0.58	0.57	35*	28	4	0.53	0.8	60*	14	6	0.62	0.48	85*	28	6	0.57	0.73
11*	28	6	0.57	0.73	36*	12	2	0.54	0.71	61*	29	10	0.62	0.48	86*	25	5	0.58	0.57
12*	22	12	0.37	0.73	37*	27	5	0.45	0.83	62*	10	1	0.68	0.44	87*	22	7	0.57	0.73
13*	28	10	0.63	0.6	38*	17	5	0.52	0.53	63*	19	7	0.43	0.4	88*	19	7	0.43	0.4
14*	25	10	0.45	0.83	39*	19	7	0.43	0.4	64*	15	12	0.58	0.57	89*	15	12	0.58	0.57
15*	28	2	0.5	0.87	40*	21	2	0.51	0.53	65*	28	6	0.57	0.73	90*	28	6	0.57	0.73
16*	16	5	0.41	0.54	41*	18	1	0.46	0.52	66*	15	5	0.45	0.83	91*	21	7	0.58	0.57
17*	26	4	0.5	0.73	42*	20	1	0.44	0.5	67*	29	5	0.57	0.8	92*	14	4	0.52	0.97
18*	22	10	0.37	0.73	43*	14	3	0.52	0.60	68*	25	10	0.58	0.5	93*	28	6	0.57	0.73
19*	26	9	0.58	0.57	44*	25	12	0.50	0.48	69*	15	12	0.58	0.57	94*	28	2	0.5	0.87
20*	4	1	0.41	0.57	45*	19	7	0.43	0.4	70*	26	4	0.5	0.73	95*	22	3	0.47	0.5
21*	19	7	0.53	0.8	46*	21	2	0.38	0.63	71*	28	6	0.57	0.73	96*	15	12	0.57	0.73
22*	9	1	0.41	0.44	47*	23	5	0.52	0.97	72*	14	7	0.52	0.60	97*	24	12	0.45	0.48
23*	14	1	0.38	0.63	48*	28	2	0.5	0.87	73*	21	1	0.62	0.48	98*	22	5	0.51	0.47
24*	20	11	0.495	0.65	49*	29	10	0.65	0.63	74*	12	10	0.50	0.48	99*	19	7	0.43	0.4
25*	10	5	0.52	0.60	50*	26	4	0.5	0.73	75*	15	12	0.58	0.57	100*	19	7	0.43	0.4

* denotes items selected for final test

Final Test

All the items in the draft test were found to be having sufficient item qualities. Thus the final test includes 100 items among which 94 are multiple choice questions and 6 are completion type. Question wise analysis was done to have an evaluation of the test developed and is given as table 9.

Table 9

Question wise Analysis of test on Mathematics Content Knowledge

Qn. No	Type of questions	Objective	Content area	Difficulty level
1	MC	Knowledge	Arithmetic	Easy
2	MC	understanding	Arithmetic	Average
3	MC	understanding	Arithmetic	Average
4	MC	Application	Arithmetic	Average
5	MC	understanding	Arithmetic	Average
6	MC	Application	Arithmetic	Average
7	MC	Application	Arithmetic	difficult
8	MC	Application	Arithmetic	average
9	MC	Application	Algebra	Average
10	MC	Understanding	Arithmetic	Average
11	MC	Understanding	Arithmetic	Average
12	MC	Understanding	Arithmetic	Difficult
13	MC	Understanding	Geometry	Easy
14	MC	Understanding	Arithmetic	Difficult
15	MC	Understanding	Arithmetic	Average
16	MC	Application	Arithmetic	Difficult
17	MC	Understanding	Geometry	Average
18	MC	Understanding	Geometry	Difficult
19	MC	Understanding	Geometry	Average

Qn. No	Type of questions	Objective	Content area	Difficulty level
20	MC	Understanding	Geometry	Difficult
21	MC	Understanding	Arithmetic	Average
22	MC	Understanding	Arithmetic	Difficult
23	MC	Application	Geometry	Difficult
24	MC	Understanding	Algebra	Average
25	MC	Understanding	Arithmetic	Average
26	Completion	Knowledge	Geometry	Average
27	Completion	Knowledge	Geometry	Easy
28	Completion	Knowledge	Geometry	Easy
29	Completion	Knowledge	Arithmetic	Average
30	MC	Knowledge	Arithmetic	Easy
31	MC	Understanding	Arithmetic	Average
32	MC	Understanding	Arithmetic	Average
33	MC	Understanding	Arithmetic	Average
34	Completion	Understanding	Geometry	Average
35	Completion	Understanding	Geometry	Average
36	MC	Understanding	Algebra	Average
37	MC	Application	Arithmetic	Difficult
38	MC	Application	Arithmetic	Average
39	MC	Understanding	Arithmetic	Difficult
40	MC	Application	Arithmetic	Average
41	MC	Application	Arithmetic	Average
42	MC	Application	Geometry	Difficult
43	MC	Understanding	Geometry	Average
44	MC	Application	Geometry	Average
45	MC	Application	Geometry	Difficult
46	MC	Application	Geometry	Difficult
47	MC	Understanding	Arithmetic	Average
48	MC	Understanding	Arithmetic	Average

Qn. No	Type of questions	Objective	Content area	Difficulty level
49	MC	Knowledge	Arithmetic	Easy
50	MC	Understanding	Arithmetic	Average
51	MC	Application	Arithmetic	Average
52	MC	Understanding	Arithmetic	Average
53	MC	Understanding	Arithmetic	Average
54	MC	Understanding	Arithmetic	Average
55	MC	Understanding	Arithmetic	Average
56	MC	Understanding	Geometry	Average
57	MC	Understanding	Geometry	Average
58	MC	Understanding	Geometry	Average
59	MC	Understanding	Geometry	Average
60	MC	Understanding	Geometry	Easy
61	MC	Knowledge	Arithmetic	Easy
62	MC	Knowledge	Arithmetic	Easy
63	MC	Application	Arithmetic	Difficult
64	MC	Knowledge	Arithmetic	Average
65	MC	Knowledge	Arithmetic	Average
66	MC	Understanding	Arithmetic	Difficult
67	MC	Knowledge	Arithmetic	Average
68	MC	Knowledge	Geometry	Average
69	MC	Knowledge	Algebra	Average
70	MC	Knowledge	Arithmetic	Average
71	MC	Knowledge	Arithmetic	Easy
72	MC	Knowledge	Arithmetic	Average
73	MC	Knowledge	Arithmetic	Easy
74	MC	Understanding	Arithmetic	Average
75	MC	Understanding	Arithmetic	Average
76	MC	Understanding	Arithmetic	Average
77	MC	Knowledge	Arithmetic	Average

Qn. No	Type of questions	Objective	Content area	Difficulty level
78	MC	Understanding	Algebra	Average
79	MC	Understanding	Arithmetic	Average
80	MC	Understanding	Arithmetic	Average
81	MC	Understanding	Arithmetic	Difficult
82	MC	Application	Geometry	Average
83	MC	Application	Geometry	Difficult
84	MC	Understanding	Algebra	Difficult
85	MC	Understanding	Geometry	Average
86	MC	Knowledge	Geometry	Average
87	MC	Knowledge	Geometry	Average
88	MC	Understanding	Geometry	Difficult
89	MC	Understanding	Geometry	Average
90	MC	Application	Arithmetic	Average
91	MC	Application	Arithmetic	Average
92	MC	Knowledge	Algebra	Average
93	MC	Knowledge	Algebra	Average
94	MC	Knowledge	Algebra	Average
95	MC	Knowledge	Arithmetic	Average
96	MC	Knowledge	Arithmetic	Average
97	MC	Knowledge	Algebra	Difficult
98	MC	Understanding	Arithmetic	Average
99	MC	Understanding	Geometry	Difficult
100	MC	Application	Geometry	Difficult

The Final test together with scoring key is given in Appendix E.

Scoring procedure

A score of 1 is given for correct response and zero for a wrong one. Thus the maximum score obtainable in the test is 100 and the minimum is zero.

Reliability of the test

Reliability of the test was calculated using Split half method. For this the response sheets of 50 students were selected randomly and the answer sheets were scored and the scores obtained for the items having odd and even number was grouped separately. Then the coefficient of correlation of the two sets of scores was found using Pearson's product moment coefficient of correlation. The coefficient of correlation obtained is 0.54, which is the reliability coefficient of the half test. The reliability coefficient of the whole test was calculated using Spearman – Brown prophecy formula (Garrette, 2007) and the value obtained is 0.70, which shows that the test possesses high reliability.

Validity

Content validity of the test was achieved by logical analysis of the content in the prescribed text books for standard 3 to 7 of Kerala state. Also proper design and blue print were prepared based on which items are prepared. Hence the test is valid to measure Mathematics content knowledge.

Observation schedule for teaching Mathematics of prospective teachers

The teaching performance of the participants was observed and rated by the investigator. For this, an observation schedule was used which was prepared by the investigator.

The schedule considered 6 areas of teaching. The details are given in Table 10.

Table 10

Observation schedule for teaching Mathematics

Sl.No	**Area**	**Items considered for assessment**
1	Planning	• Well-structured Pedagogic analysis • suitable activities • Teaching manual-structure • Detailing of activities • follow-up activities
2	Implementation of the learning activities	• Test of previous knowledge • Presentation of new content • Activities according to student level and L.O • Participation of students in activities • consolidation of activities
3	Use of learning strategies and TLMs	• Effective use of methodology • effective group work • use of BB • use of ICT • use of apt TLM
4	Evaluation	• Initiative to conduct the CE • suitable questions • considering portfolio • suitable strategy • Change in the learning process according to the response of students

Sl.No	Area	Items considered for assessment
5	Learning Environment	• Freedom to ask doubts • individual attention • discipline • Space management • student friendly
6	Consolidation	• Related to learning outcome • Questions to understand student level • Appropriate student responses • Appropriate follow-up activities • Time management

The rating is as 5, 4, 3, 2, 1 respectively to the performance of the prospective teachers as per the number of criteria present in each area.

Scoring was done according to the specifications given under each item. At each stage of classroom instruction, the observer has to provide appropriate scores according to the performance of the teacher. In the planning stage, the score is to be given by assessing the lesson plan prepared by the teacher for that particular class.

Reliability and Validity of the observation schedule.

Two Mathematics teacher educators observed the same class and assessed the performance of 14 students using the observation schedule without consultation. Then the scores obtained from the two observations of the 14 students were correlated and the correlation coefficient obtained is .72. Hence the observation schedule can be considered as having sufficient reliability and validity.

Development of the Self learning Module.

To be a successful teacher, one needs to have mastery over both content and methodology related to the classroom transaction. Content analysis of the text books up to seventh standard revealed that the major branches of mathematics dealt in these classes are arithmetic and geometry with a small representation of algebra. The test on mathematics content knowledge was developed based on these areas with due representation as in syllabi. The topics included in the test are Numbers, Fractions, Percentage, Decimal numbers, Ratio & Proportion, Geometry and Algebra. The percentage scores obtained by 100 D.Ed students in the initial survey is given as table 11.

Table 11

Percentage of scores obtained by D.Ed students

Area	No. of questions	Percentage score
Fraction	20	17.60
Number sense	25	34.28
Percentage	8	31.38
Proportion & Ratio	6	35.67
Decimal Numbers	7	27.71
Algebra	6	16.50
Geometry	28	19.57
Total	100	25.13

The analysis of the performance level of the target group in the test on MCK evidently shows that their content knowledge is not rich enough in numbers, Fractions, Percentage, Decimal numbers, Ratio & Proportion, Geometry and Algebra. It is also found that 'fractions' and ‘algebra’ are the units where they feel difficulty at the maximum. By considering the purpose of teaching the content area ‘fractions’ during the internship of the prospective teachers and as a small content of algebra is covered at the primary level than fractions, the investigator developed the pedagogic module with respect to the content area ‘fractions’

In view of the findings of the survey, the investigator decided to develop content enrichment module for the units in Arithmetic viz., Fractions, Percentage, Decimal numbers, Ratio & Proportion; Geometry and Algebra. Number sense being the basic for all, and familiar to the students, Special cards in digital format was given. This will help the prospective teachers to enrich their awareness and depth in terms of concepts and mathematical derivations.

At the same time the investigator decided to develop pedagogic self-learning module in the area of 'fractions' due to the following reasons.

1. The intensity of the difficulty met by the target group is very high in this area when compared with the other four areas in arithmetic.
2. The prospective teachers have to deal with the portion related to 'fraction' as they undergo internship in schools.

Hence, it is decided to develop two modules viz., content on Fractions, Percentage, Decimal numbers, Ratio & Proportion, Geometry and Algebra (with digital version) and pedagogy pertaining to fraction.

Strategy adopted to develop the module

Developing a module frame was the initial step for which the investigator conducted detailed discussion with experts in the concerned area and also made use of reference materials fit for the purpose. Based on the need and requirement of the target group, objectives were formulated pertaining to each area. For the six area under consideration, viz., Fractions, Percentage, Decimal numbers, Ratio and Proportion, Geometry and Algebra content enrichment modules were developed. A pedagogic support module was also developed for ensuring better transaction in 'fraction'. Vigilance was also kept to ensure that the module is developed with proper scientific footing . The steps followed in the construction of the module is that recommended by Sharma(2000).

Design of the content module

A common module frame was developed before attempting the content module pertaining to all the six areas. The general structure is as follows (Sharma, 2005).

Introduction

This part points out the importance of the topic and the need and significance of learning the content in a life related as well as mathematical perspective.

Objectives

Here the objectives of the content module are listed at micro level.

Main concepts

Since mathematics is a life-oriented subject, all mathematical concepts need to be presented in its most simplified form, especially at primary or entry level. Here the concepts are presented in the very same spirit. To make the teaching/learning easier, sub-concepts are also presented in a convincing manner with proper examples.

Activities and Examples

Activities are designed in relation with the perception level of the prospective teachers. Examples given in this area are for helping them for easy conceptualization. The investigator kept proper vigilance for incorporating ICT integration in areas wherever possible. Being a Self-learning module, this will help them for better acquisition of the content.

Consolidation

This section gives importance to sum up the conceptual ideas under the unit in a practical and logical spirit.

Unit-end activities

By the end of each module, the prospective teachers may undergo a self check mechanism leading to better perception and confidence over the content. This is a collection of such items.

Pedagogic Module

From the preliminary analysis of responses on the test on MCK, it has been found that, in arithmetic, 'fraction' is the most difficult area for the prospective teachers. This module has the following eight sections. (Sharma, 2005).

1. Introduction

In addition to the historical and logical parameters, this part provides special attention to the pedagogic aspects helping a comfortable and easy transaction of the content. Proper vigilance was kept for threading the content with most appropriate and feasible techniques.

2. Module Frame

Apart from the concepts, this part discusses various teaching learning process sensibly linked with learning outcomes put forward by the curriculum. Hence the investigator attempted to ensure co-ordination of the three major components viz., Concepts, teaching-learning process and the expected learning outcomes.

3. Methodology

In view of the prescribed contents and the pedagogic content knowledge level of the target group, the investigator visioned appropriate techniques and strategies for each and every concept and are specified minutely. Familiarizing the concept of fraction, inductive-deductive method, experimental method and heuristic method are used according to the context.

4. Previous Knowledge

These areas gives a brief outline of the pre-requisites on the part of the target groups for better transaction and are specified at micro level.

5. Teaching-learning materials

Instead of using the conventional teaching-learning material, the module visualises and suggests using typical TLMs including ICT materials. It is felt that in the very context of dissemination of the use of ICT materials in the classrooms, the attempt is of high pedagogic significance. Various types of worksheets are also developed for the purpose.

6. Learning activities

This is a unique collection of activities which are developed exclusively for transacting the concepts. Efforts are taken to ensure the quality of activities in terms of logical reasoning, achievement of skills and concept attainment. The module also helps the target group for self-learning.

7. Consolidation

The concepts developed at each stage of learning are subjected for summing up. This ensures comprehensiveness on the part of the target group.

8. Assessment

This part is crucial in the sense that it helps the prospective teachers for the following.

- Introspection
- Self-reflection.
- Know/Check the level at which process skills are attained.
- Apply the acquired knowledge in practical situations.(Sharma, 2000)

The constructed module both content and pedagogic parts are presented as Appendix F (Both Malayalam and English versions). The digital support of the module is given as Appendix G.

To validate the module, a rating scale on different aspects under content and structure was given to 16 teacher educators at primary level. All teacher educators agreed upon the dimensions of the content and structure, comprehensiveness, correctness, clarity, simplicity, needfulness, orderliness and digital support. Positive comments on the usefulness and need of the module reveals that the module is valid to improve the content knowledge and teaching in mathematics.

The response sheets are given as Appendix H.

Data Collection procedure

The investigator conducted a survey on MCK and attitude towards mathematics among prospective teachers. For this the tools were administered on a sample of 100 D.Ed students of five teacher education institutions of four districts. The investigator contacted the respective principals and sought permission for the collection of data. First year students were included in the study. The tools were administered with proper instructions and after prescribed time (test on MCK) the response sheets were collected back and scored as per the scoring procedure.

After the module is constructed, the digital version was sent through email to individual teacher educators and then personally met to get data on the rating of the module.

The constructed module was experimented on a group of 40 first year prospective teachers of DIET, Palakkad. The control group included 40 first year students of DIET, Malappuram with whom the performance of the experimental group was compared. After finalizing the experimental and control groups, the investigator administered the instruments, Scale of Attitude towards Mathematics, Mathematics Aptitude Test and test on MCK at primary level to both groups.

Then the module was introduced to the experimental group where as no special attention was given to the control group. Since the module is a self-learning one, students were allowed to take their copy to home and were able to learn the module at their own pace. Doubts if any were clarified and frequently enquired on the progress. After two months of introducing the module (content part), during internship programme, the pedagogic part was introduced to the experimental group. A digital platform of both content and pedagogic module were also provided to the experimental group in the form of CD named *TiME (*Technology in Mathematics Education). The CD contains two versions (Malayalam and English) of SLM.

Then classes of participants of both experimental and control groups were observed and rated by the investigator using an observation schedule. Then after internship programme, the instruments, Scale of Attitude towards Mathematics and Test on mathematics content knowledge at primary level were administered to both groups.

Scoring and consolidation of data

After each administration, the data sheets of each instrument was scored as per the respective scoring procedure and tabulated in excel format.

Statistical techniques used

The tabulated data was analysed using Statistical Package for Social Sciences (SPSS) as per the objectives of the study. Preliminary statistics like mean and standard deviation was calculated.

The inferential statistics used for testing hypotheses are

- Test of significance of mean difference for two large independent groups.
- Test of significance of mean difference for large dependent groups.
- Analysis of Co-variance
- Cohen's d for calculating the effect size.

Test of significance of mean difference for two large independent groups

Test of significance of difference between means for large independent groups was used as a two-tailed test to test whether the mean scores of experimental and control groups differ significantly .The critical ratio is calculated by the formula

$$t = \frac{M_1 - M_2}{\sigma_D} \qquad \text{(Garett, 2007)}$$

Where, M_1 is the mean of the Experimental group

M_2 is the mean of the Control group

and standard error is $\sigma_D = \sqrt{\frac{\sigma_1{}^2}{N_1} + \frac{\sigma_2{}^2}{N_2}}$

where σ_1=Standard deviation of the Experimental group

σ_2=Standard deviation of the Control group

N_1=Size of the Experimental group

N_2=Size of the Control group

When the critical ratio exceeds 1.96 (.05 level) or 2.58 (.01 level) the tabled values for significance, difference between the experimental and control groups will be treated as significant.

Test of significance of mean difference for two large dependent groups

Test of significance of mean difference for two large dependent groups was used to test the significance of difference between mean scores of pre- tests and post-tests of both experimental and control groups.

The critical ratio is calculated by the formula

$$t = \frac{M_1 - M_2}{\sqrt{\frac{\sigma_1{}^2}{N_1} + \frac{\sigma_2{}^2}{N_2} - 2r\frac{\sigma_1{}^2\sigma_2{}^2}{N_1 N_2}}}$$

Where, M_1 is the mean of the experimental group

M_2 is the mean of the control group

σ_1=Standard deviation of the experimental group

σ_2=Standard deviation of the control group

N_1=Size of the experimental grou

N_2=Size of the control group and 'r' the Pearson's coefficient of correlation between the two sets of scores.

If the obtained value is greater than the value required for significance at the specified level, it is taken as there is difference between the two group means.

Analysis of Co-variance

ANCOVA is a powerful statistical tool for test of significance of difference between means. It is used to examine if there is significant difference between the group means in view of the inherent variability within the separate groups.

ANCOVA is a very effective technique of testing experimental hypotheses especially when the groups to be compared are initially unlike in some relevant variables Hence ANCOVA is used to know whether the SLM has significant effect on MCK, Attitude towards Mathematics and Teaching Performance in Mathematics when scores on Mathematics Aptitude is controlled statistically.

Cohen's d for calculating effect size

To calculate the effect size of the treatment variable on the dependent variables Cohen’s d was calculated using the formula

$$d = \frac{M_1 - M_2}{SD_{pooled}}$$

when there is homogeneity of variance and Glass’s delta using the formula

$$\Delta = \frac{M_1 - M_2}{SD_{control}}$$

When unequal standard deviations exist. A value greater than .8 shows a large effect.

SAHEEDALI M. “DEVELOPMENT OF A MODULE TO ENHANCE THE PERFORMANCE IN TEACHING MATHEMATICS AMONG PROSPECTIVE TEACHERS AT PRIMARY LEVEL”. THESIS. F AR O O K TR AI N I N G C O L L EG E, RESEARCH CENTRE IN EDUCATION, UNIVERSITY OF CALICUT, 2018.

Chapter 4

ANALYSIS AND INTERPRETATION

- *Extent of MCK, Attitude towards Mathematics and Mathematics Aptitude among prospective teachers*
- *Effect of the developed SLM on Teaching Mathematics, MCK and Attitude towards Mathematics*

Analysis of the collected data was done on the basis of the objectives of the study. Details of the analysis and discussion of results are presented under major headings viz.,

Extent of Mathematics Content Knowledge (MCK), Attitude towards Mathematics and Mathematics Aptitude among prospective teachers.

Comparison of pre-test mean scores on MCK, Attitude towards Mathematics and Mathematics Aptitude of experimental and control groups.

Effect of the developed SLM on Teaching Mathematics, MCK and Attitude towards Mathematics.

The details of analysis and discussion of results are presented below.

Extent of Mathematics Content Knowledge, Attitude towards Mathematics and Mathematics Aptitude among prospective teachers at primary level

To know the extent of Mathematics Content Knowledge and Attitude towards Mathematics and Mathematics Aptitude among prospective teachers at primary level at the beginning of the D.Ed course, mean and standard deviation of the respective scores were calculated for the total sample selected for the survey. The mean and standard deviations on the scores on Mathematics Aptitude of the sample included in the experiment is also calculated. The details of the analysis are given in Table 12.

Table 12

Mean and standard deviation of the scores on Mathematics Content Knowledge, Attitude towards Mathematics and Mathematics Aptitude

Variable	N	Mean	SD	Minimum	Maximum
Mathematics content Knowledge	100	25.13	7.43	10	43
Attitude towards Mathematics	100	84.23	12.07	57	113
Mathematics Aptitude	80	29.78	6.91	18	47

The mean score obtained for Mathematics Content Knowledge is 25.13 with a standard deviation of 7.43. The maximum score obtainable for the test is 100 indicating that the mean score is too low. That is prospective teachers at primary level have a low level of Mathematics Content Knowledge at the entry level of their training programme. Also the least score obtained is 10 and the maximum score is 43. This indicates that the initial level of Mathematics Content Knowledge among prospective teachers at primary level is not at all satisfactory.

This finding is concomitant with that of Corcoran (2005) and Lowrie and Jorgensen (2015) in which D.Ed students of various states and countries are found to have low Mathematics Content Knowledge .

Also, the mean score obtained for Attitude towards Mathematics is 84.23 with a standard deviation of 12.07. The maximum score and minimum score obtainable on the scale are 160 and 32 respectively. This indicates that the mean score is very low. While considering the moderate score 3 of the attitude scale, the total score obtainable is 96, which indicates a neutral position regarding Mathematics. But a mean score less than this neutral value shows a negative attitude towards Mathematics among D.Ed students. The minimum score obtained is 57 and maximum score obtained is 113 which again indicate an unsatisfactory level of attitude among primary level prospective teachers towards Mathematics.

The findings of Bolden and Barmby (2014) and Amato (2004) revealed that negative attitude exists among prospective teachers at the initial stage of the teacher training course and the findings of studies by Bose (1993), Akkaya and Memnun (2012) indicate the significant relation between positive attitude towards Mathematics and previous academic achievement among the prospective teachers.

From table 12, it can be seen that the mean score of Mathematics Aptitude is 29.78 with a standard deviation of 6.91. The maximum score obtainable in the test is 67 which indicate the obtained mean score is considerably low. That is D.Ed students have a low level of Mathematics Aptitude. The minimum score obtained is 18 and maximum is 47. Hence D.Ed students have low level of Mathematics Aptitude.

Comparison of pre-test mean scores on Mathematics Content Knowledge, Attitude towards Mathematics and Mathematics Aptitude of experimental and control groups

To compare the pre-test mean scores on Mathematics Content Knowledge (MCK), Attitude towards Mathematics and Mathematics Aptitude of experimental and control groups, two-tailed test of significance of difference between means for large independent groups was used and the results are presented in table 13.

Table 13

Details of test of Significance of difference in Pre-test mean scores on MCK, Attitude towards Mathematics and Mathematics Aptitude of experimental and control groups

Sl. No	Variable	Groups	N	Mean	SD	Critical Ratio
1	MCK	Experimental	40	14.28	5.213	1.704
		Control	40	12.52	3.876	
2	Attitude towards Mathematics	Experimental	40	90.88	13.717	4.341**
		Control	40	78.40	11.927	
3	Mathematics Aptitude	Experimental	40	29.60	7.847	0.225
		Control	40	29.95	5.922	

** denotes $p \leq .01$

Table 13 shows that the critical ratio obtained for the variable Mathematics Content Knowledge (Pre-test Scores) is 1.704 which is less than 1.96, the value required for significance of Mean difference at .05 level. Hence the difference in the mean scores of Mathematics Content Knowledge of experimental and control groups at the initial level is not significant even at .05 level of significance. Hence it can be considered as the two groups do not differ in their initial level of Mathematics Content Knowledge.

In the case of Attitude towards Mathematics, the critical ratio obtained is 4.341 which is greater than 2.58, the value required for significance at .01 level. That is, the experimental and control groups differ significantly in their initial level of Attitude towards Mathematics. The mean scores of experimental and control groups are 90.88 and 78.40 with Standard deviation 13.717 and 11.927. Since the mean scores are less than the middle score on the scale (96), it can be considered that both groups are not having positive attitude towards mathematics. Hence though the two groups differ significantly in their mean scores on initial level of Attitude towards Mathematics, favoring the experimental group, both groups are generally having negative attitude towards the subject.

In the case of Mathematics Aptitude, the critical ratio obtained is 0.225 which is less than 1.96, the value required for significance of mean difference at .05 level. Hence the difference in the mean scores of Mathematics Aptitude of experimental and control groups at the initial level is not significant even at .05 level of significance. Hence it can be considered as the two groups do not differ in their Mathematics Aptitude.

For easy comparison of the mean scores of experimental and control groups on MCK, Attitude towards Mathematics and Mathematics Aptitude a bar diagram is given as figure 5.

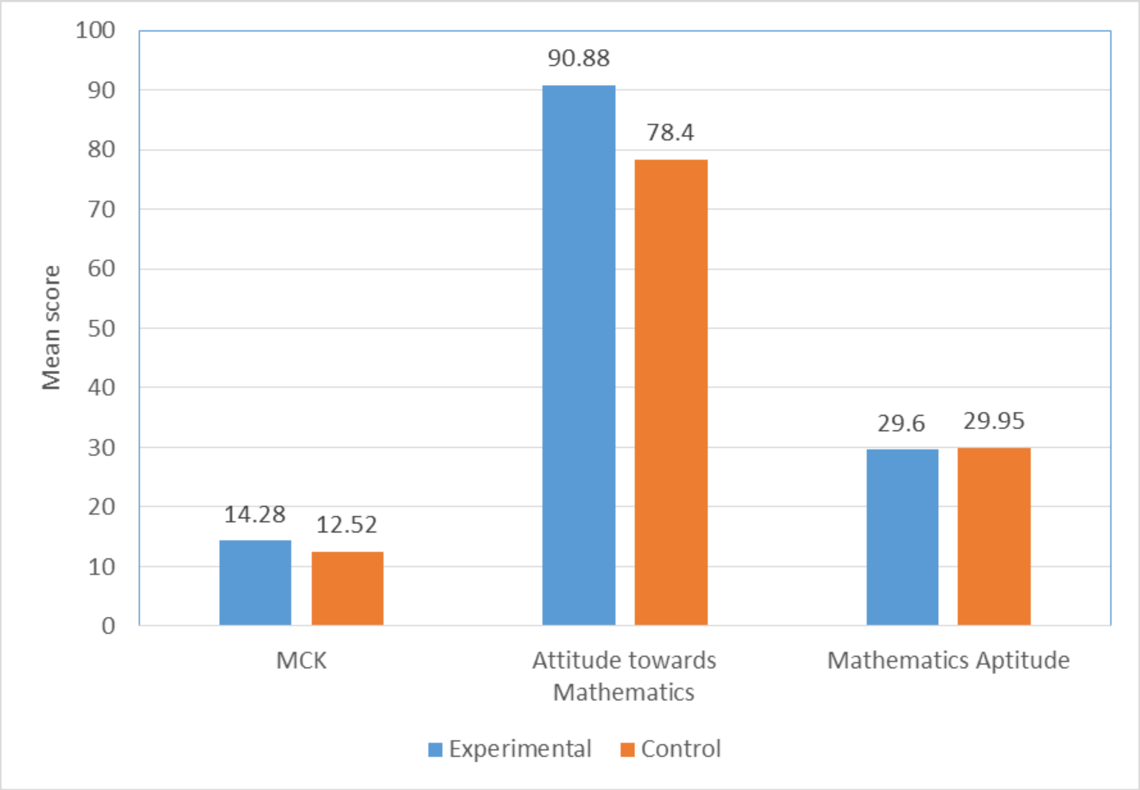


Figure 5: Pre-test mean scores on MCK, Attitude towards Mathematics and Mathematics Aptitude of experimental and control groups

The diagram shows that mean scores of the variables MCK and Mathematics aptitude of experimental and control groups are almost same where as experimental group has a higher mean score in Attitude towards mathematics.

Effect of the developed SLM on Teaching Mathematics, MCK and Attitude towards Mathematics

Effect of the developed SLM on Teaching performance, MCK and Attitude towards Mathematics was tested by comparing the mean scores of these variables between experimental and control groups in the post test and gain scores and also comparing the pre and post test scores of both experimental and control groups.

Comparison of pre-test and post-test mean scores of MCK and Attitude towards Mathematics of both Experimental and Control groups.

To test whether there is significant difference in the Pre-test and Post-test mean scores of Mathematics Content Knowledge (MCK) and Attitude towards Mathematics of experimental as well as the control group, test of significance of mean difference for large dependent groups was employed. The results are presented as table 14**.**

Table 14

Details of test of significance of mean difference in Pre-test and Post-test scores of Mathematics Content Knowledge and Attitude towards Mathematics of Experimental and Control groups.

Group	N	Variables	Pre-test		Post-test		'r'	Critical Ratio
			Mean	S.D	Mean	S.D		
Experimental	40	MCK	14.28	5.213	34.65	8.069	.503	18.236**
		Attitude towards Mathematics	90.88	13.717	113.42	17.221	.794	13.611**
Control	40	MCK	12.52	3.876	13.95	4.350	.938	5.940**
		Attitude towards Mathematics	78.40	11.927	79.25	11.666	.991	3.339 **

** denotes p≤ .01

The critical ratio obtained for the experimental group on the pr- test and post-test mean scores of MCK is 18.236 (Table 14) which is greater than the required value for significance at .01 level (2.71, df=39). Hence the mean scores of pre-test and post-test on MCK of the experimental group differ significantly. Though a two tailed test of significance was used, a close observation of the mean scores reveals that the mean score of post-test on MCK of the experimental group is considerably higher than that of pre-test.

The critical ratio calculated for the pre-test and post-test mean scores on Attitude towards Mathematics of the experimental group is 13.611, a higher value than 2.71, the value required for significance at .01 level for 39 degrees of freedom. This indicates that the mean score of Attitude towards Mathematics of the experimental group differ significantly before and after the treatment. The mean scores of the pre-test and post-test show that the treatment has made the experimental group develop a positive Attitude towards Mathematics.

Table 14 shows that the critical ratio obtained for the variable Mathematics Content Knowledge of the control group is 5.94 which is greater than 2.71, the value required for significance of mean difference at .01 level (df=39). That is, there is significant difference in the pre-test and post-test mean scores of MCK of the control group.

Also Table 14 shows that the critical value obtained for Attitude towards Mathematics of the Control group is 3.339 and it is greater than the value needed for significance at .01 level (df=39). So, there is significant difference in the pre-test and post-test mean scores of Attitude towards Mathematics of the control group. But close observation of the mean values reveals that the control group has a negative attitude towards Mathematics even after their D.Ed programme.

Both control and experimental groups differ significantly in their pre-test and post-test mean scores on MCK and Attitude towards Mathematics. The change in the control group is due to the D.Ed programme they have undergone, but the changes in the mean scores are very small compared to that of experimental group. That is when SLM was introduced together with the D.Ed programme, mean scores on MCK and Attitude towards Mathematics have increased. A negative attitude towards Mathematics among D.Ed students was changed to positive by implementation of the developed SLM.

The mean comparison of experimental group is presented in the form of a bar diagram and is given as figure 6 and that of control group is given as figure 7.

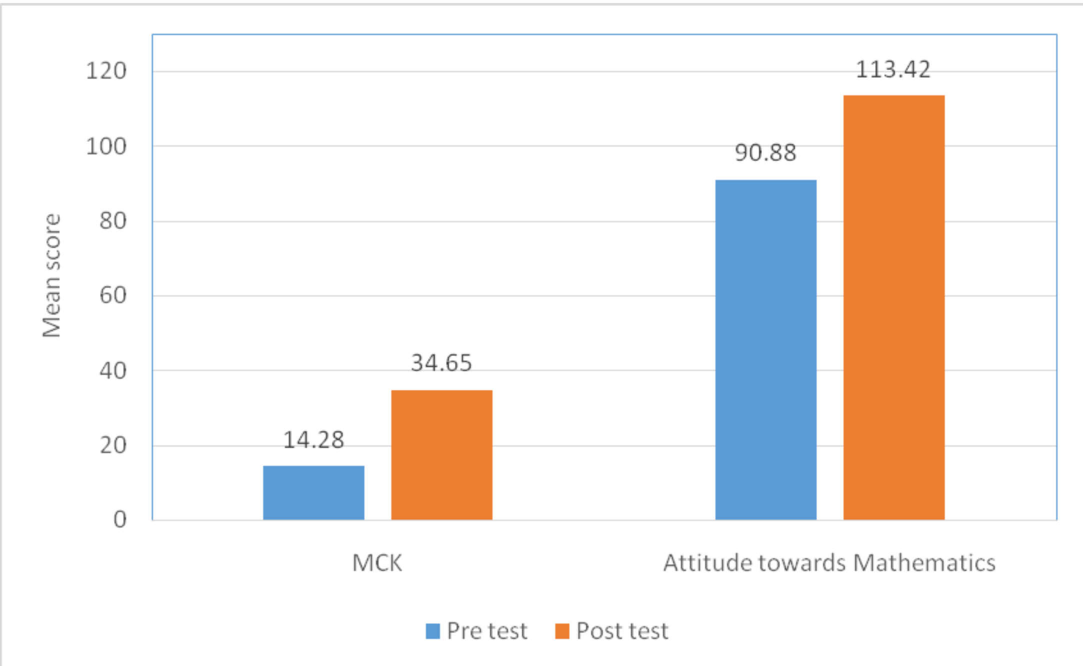


Figure 6. Comparison between pre-test and post scores of MCK and Attitude towards Mathematics of experimental group.

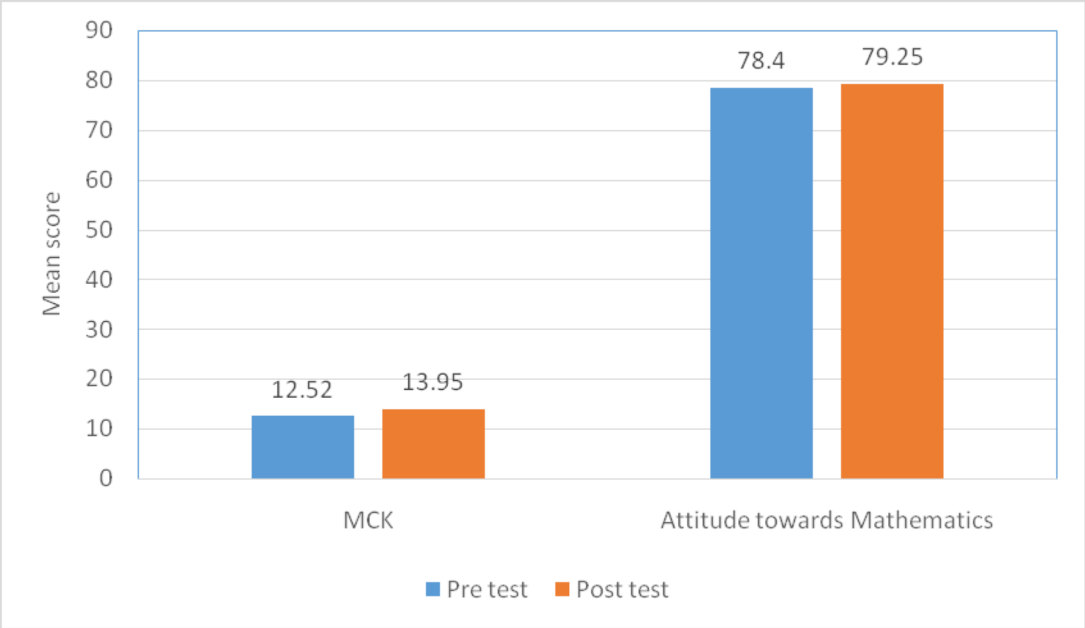


Figure 7. Comparison between pre-test and post scores of MCK and Attitude towards Mathematics of control group.

Figure 6 and 7 reveals that both experimental and control groups have greater mean scores in MCK and Attitude towards mathematics in the post test than in the pre-test indicating both groups have improved their MCK and Attitude towards mathematics.

Comparison of post-test mean scores of Teaching Mathematics, MCK and Attitude towards Mathematics between experimental and control groups

The post-test mean scores of Teaching mathematics, MCK and Attitude towards Mathematics of Experimental and Control groups were compared using test of significance of mean difference for large independent groups, the details of which are given as table 15.

Table 15

Details of test of Significance of Mean difference of Post-test scores on Teaching Mathematics, MCK and Attitude towards Mathematics of experimental and control groups

Variable	Groups	N	Mean	SD	Critical Ratio
Teaching Mathematics	Experimental	40	59.82	6.961	13.303**
	Control	40	40.08	6.302	
MCK	Experimental	40	34.65	8.069	14.282**
	Control	40	13.95	4.35	
Attitude towards Mathematics	Experimental	40	113.42	17.221	10.391**
	Control	40	79.25	11.666	

** denotes $p \leq .01$

Table 15 shows that the critical ratio obtained for Teaching of experimental and control groups is 13.303, a value higher than 2.58, the value required for significance at .01 level. It means that the two groups differ significantly ($p \leq .01$) in their mean scores on Teaching mathematics. A higher value of mean score of the experimental group shows that the treatment with SLM has improved the Teaching of D.Ed students.

Also, Table 15 shows that the critical ratio obtained for the variable Mathematics Content Knowledge (Post-test Scores) is 14.282 which is greater than 2.58, the value required for significance of Mean difference at .01 level. Hence the difference in the post-test mean scores of Mathematics Content Knowledge of experimental and control groups is significant at .01 level. That is, the two groups differ significantly in their post-test mean scores of Mathematics Content Knowledge.

In the case of Attitude towards Mathematics, the critical ratio obtained is 10.391 which is greater than 2.58, the value required for significance at .01 level. That is, the Experimental and Control groups differ significantly in their post-test mean scores of Attitude towards Mathematics ($p \leq .01$).

The mean scores of Experimental and Control groups for the variable MCK are 34.65 and 13.95 respectively with Standard deviation 8.069 and 4.35. Since the mean score of the Experimental group is greater than that of the control group, it can be inferred that the experimental group has higher mean score in Mathematics Content Knowledge than the control group after the treatment.

Also the mean scores of Attitude towards Mathematics of experimental and control groups are 113.42 and 79.25 with standard deviation 17.221 and 11.666 respectively. It can be interpreted that mean score of Attitude towards Mathematics of the experimental group is higher than that of the control group. The mean score of post-test on Attitude towards Mathematics of control group is less than the neutral value in the scale (96) and hence the control group has a negative attitude towards the subject even after the D.Ed programme. The mean score of post- test on Attitude towards Mathematics of experimental group is 113.42 which is greater than 96 and hence the treatment has improved the attitude of students towards the subject.

The comparison of mean scores on Teaching Mathematics, MCK and Attitude towards Mathematics of Experimental and control groups in the form of bar diagram is presented in figure 8.

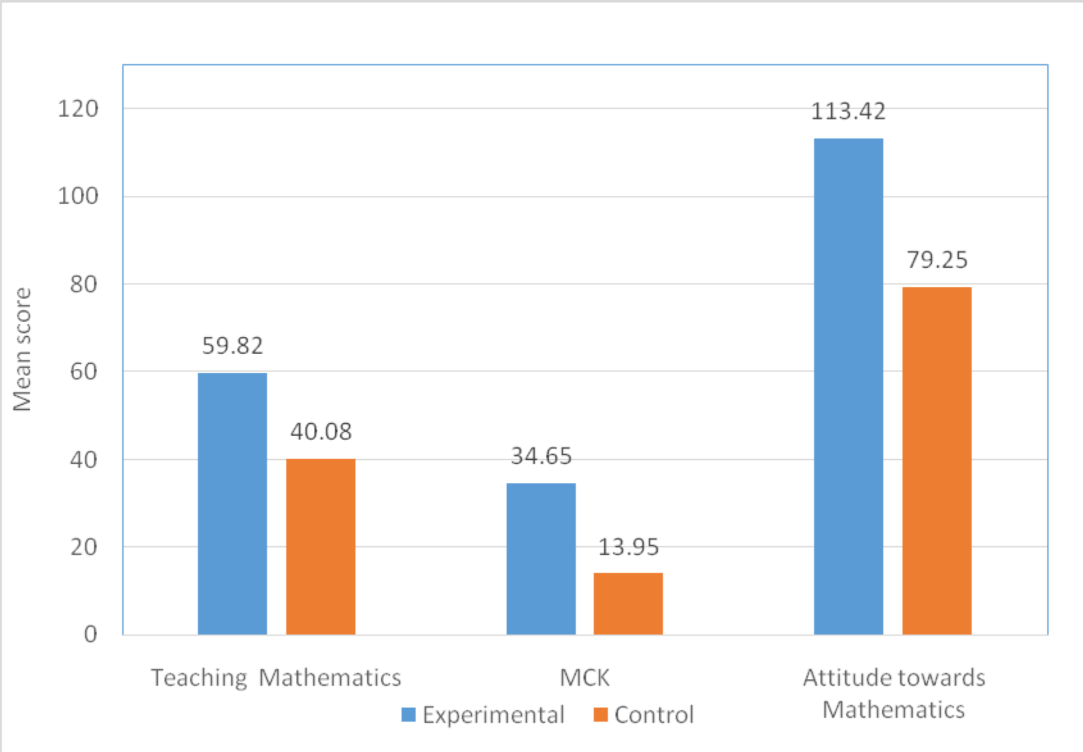


Figure 8. Post-test mean scores on Teaching Mathematics, MCK and Attitude towards Mathematics of experimental and control groups.

Figure 8 shows the difference in the mean scores of teaching mathematics, MCK and Attitude towards Mathematics of experimental and control group.

Comparison of mean gain scores of MCK and Attitude towards Mathematics between experimental and control groups

The gain scores on MCK and Attitude towards Mathematics were calculated by finding the difference of Post test score and Pre-test score of the variables. The mean gain scores of experimental and control groups were compared using test of significance of mean difference for large independent samples. The details are given as table 16.

Table 16

Details of test of Significance of Mean difference of Gain scores on Mathematics Content Knowledge (MCK) and Attitude towards Mathematics of experimental and control groups

Variable	Groups	N	Mean	SD	Critical Ratio
MCK	Experimental	40	20.38	7.066	16.583**
	Control	40	1.42	1.517	
Attitude towards Mathematics	Experimental	40	22.55	10.478	12.946**
	Control	40	.85	1.610	

** denotes $p \leq .01$

Table 16 shows that the critical ratio obtained for the mean gain scores on MCK of experimental and control groups is 16.583 which is greater than 2.58 the value required for significance at .01 level. Hence the mean difference in the gain scores on MCK between experimental and control groups is significant at .01 level. That is experimental group and control group differ significantly in the mean gain scores on MCK. A higher value of mean for the experimental group compared to control group shows that the treatment has improved the MCK of D.Ed students.

The critical ratio in the case of gain scores on Attitude towards Mathematics is 12.946 which indicates a significant difference in the mean gain scores between experimental and control groups ($p \leq .01$). A higher mean score for the experimental group shows that the treatment with the developed SLM has improved the attitude of D.Ed students towards Mathematics.

The Comparison of mean gain scores of MCK and Attitude towards Mathematics between experimental and control groups in the form a bar diagram is given as figure 9.

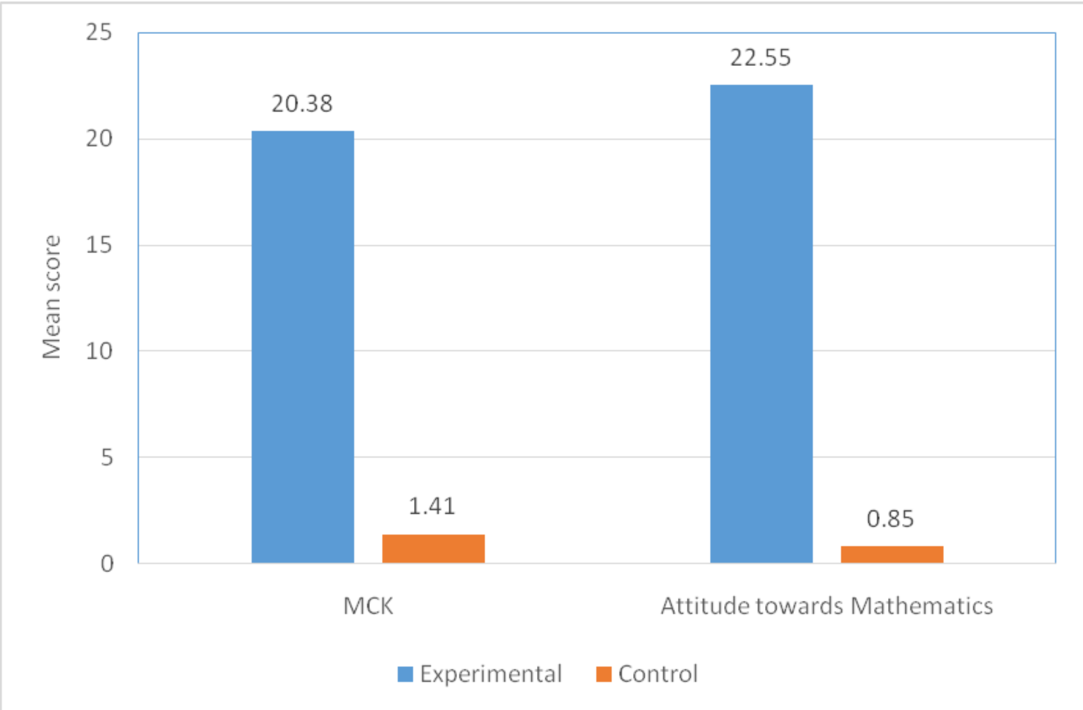


Figure 9. Mean gain scores of MCK and Attitude towards Mathematics between experimental and control groups.

Figure 9 shows that the experimental group has a higher mean gain score in MCK and Attitude towards Mathematics compared to that of control group.

Analysis of Variances of Teaching Mathematics, Mathematics Content Knowledge and Attitude towards Mathematics by Group with Mathematics Aptitude as Covariate

In order to know the effectiveness of the SLM on Teaching Mathematics, MCK and Attitude towards Mathematics of prospective teachers when the influence of Mathematics Aptitude is controlled, one way ANCOVA was used. In order to make the interpretation more accurate, one-way ANOVA for each variable was done followed by the respective ANCOVA with Mathematics Aptitude as co-variate. The details of one-way ANOVA and ANCOVA for the variable Teaching Mathematics is given in Table 17 and Table 18.

Table 17

Details of ANOVA of Teaching Mathematics by groups

Source of variance	Sum of squares	df	Mean square	F
Corrected Model	7801.250	1	7801.250	176.963**
Intercept	19960.200	1	19960.200	4.528**
Group	7801.250	1	7801.250	176.963**
Error	3438.550	78	44.084	
Corrected total	11239.800	79		

** denotes $p \leq .01$

Table 18

Details of ANCOVA of Teaching Mathematics by group with Mathematics Aptitude as co-variate

Source	Sum of Squares	df	Mean square	F
Corrected Model	8105.176	2	4052.588	99.549**
Intercept	6951.687	1	6951.687	170.764**
Mathematics Aptitude	303.926	1	303.926	7.466**
Group	7874.841	1	7874.841	193.440**
Error	3134.624	77	40.709	
Corrected total	11239.800	79		

** denotes $p \leq .01$

The variance explained by the model in one-way ANOVA is 7801.250 (Table 17) where as it is 8105.176 when Mathematics Aptitude is controlled by taking it as a co-variate (Table 18). That is, when influence of Mathematics Aptitude on Teaching Mathematics is controlled, the variance explained by the model has increased by 304. The between group variance was 7801.250 when the influence of Mathematics Aptitude was not controlled, and it has increased to 7874.841, when Mathematics Aptitude is taken as a co-variate. That is, when the influence of Mathematics Aptitude is controlled, the variance between groups has increased. The variance not explained by the model has decreased from 3438.550 to 3134.624. The F value obtained for the groups is greater than the value required for significance at .01 level with (1,79) degrees of freedom both in one-way ANOVA and one-way ANCOVA indicating that the experimental and control groups differ in their Teaching, irrespective of their Mathematics Aptitude.

ANOVA and ANCOVA of MCK by group were executed with Mathematics Aptitude as co-variate. The details are given as Table 19 and Table 20.

Table 19

Details of ANOVA of MCK by groups

Source	Sum of squares	df	Mean square	F
Corrected Model	8569.800	1	8569.800	203.981**
Intercept	47239.200	1	47239.200	1124**
Group	8569.800	1	8569.800	203.981**
Error	3277.000	78	42.013	
Corrected total	11846.800	79		

** denotes p≤ .01

Table 20

Details of ANCOVA of MCK by group with Mathematics Aptitude as co-variate

Source of variance	Sum of Squares	df	Mean square	F
Corrected Model	8673.859	2	4336.930	105.247**
Intercept	1512.108	1	1512.108	36.695**
Mathematics Aptitude	104.59	1	104.59	2.525
Group	8612.420	1	8612.420	209.004**
Error	3172.941	77	41.207	
Corrected total	11846.800	79		

** denotes p≤ .01

The variance on MCK explained by the model in one-way ANOVA is 8569.800 (Table 19)where as it is 8673.859 when Mathematics Aptitude is controlled by taking it as a co-variate (Table 20).

That is, when influence of Mathematics Aptitude on MCK is controlled, the variance explained by the model has increased by 104. The between group variance was 8569.800 when the influence of Mathematics Aptitude was not controlled and it has increased to 8612.420 when Mathematics Aptitude is taken as a co-variate. That is, when the influence of Mathematics Aptitude is controlled, the variance between groups has increased. The variance not explained by the model has reduced from 3277.000 to 3172.941.

The F value obtained for the groups is greater than the value required for significance at .01 level with (1,79) degrees of freedom both in one-way ANOVA and one-way ANCOVA indicating that the experimental and control groups differ in their post-test mean score on MCK, irrespective of their Mathematics Aptitude.

ANOVA and ANCOVA of Attitude towards mathematics by group were executed with Mathematics Aptitude as co-variate. The details are given as Table 21 and Table 22.

Table 21

Details of ANOVA of Attitude towards Mathematics by groups

Source of variane	Sum of squares	df	Mean square	F
Corrected Model	23358.612	1	23358.612	107.98**
Intercept	742473.113	1	742473.113	3432**
Group	23358.612	1	23358.612	107.98**
Error	16873.275	78	216.324	
Corrected total	40231.888	79		

Table 22

Details of ANCOVA of Attitude towards Mathematics by group with Mathematics Aptitude as co-variate

Source of variance	Sum of Squares	df	Mean square	F
Corrected Model	23704.772	2	11852.386	55.220**
Intercept	30779.669	1	30779.669	143.403**
Mathematics Aptitude	346.160	1	346.160	1.613
Group	23488.559	1	23488.559	109.433**
Error	16527.115	77	214.638	
Corrected total	40231.888	79		

The variance explained by the model in one-way ANOVA is 23358.612 (Table 20) where as it is 23704.772 when Mathematics Aptitude is controlled by taking it as a co-variate (Table 21). That is when influence of Mathematics Aptitude on Attitude towards Mathematics is controlled, the variance explained by the model has increased by 346. The between group variance was 23358.612 when the influence of Mathematics Aptitude was not controlled, and it has increased to 23488.559 when Mathematics Aptitude is taken as a co-variate. That is, when the influence of Mathematics Aptitude is controlled, the variance between groups has increased. The variance not explained by the model has reduced from 16873.275 to 16527.115.

The F value obtained for the groups is greater than the value required for significance at .01 level with (1,79) degrees of freedom both in one-way ANOVA and one-way ANCOVA indicating that the experimental and control groups differ in their post-test mean score on Attitude towards Mathematics, irrespective of their Mathematics Aptitude.

Effect Size of the Developed SLM on Teaching Mathematics, MCK and Attitude towards Mathematics

The effect size was calculated for the variables Teaching Mathematics, Mathematics Content Knowledge and Attitude towards Mathematics. Cohen’s d was calculated for Teaching Mathematics as the standard deviations for this variable of the experimental and control groups are homogeneous. For the other two variables to calculate the effect size, Glass Delta was calculated as the two groups have different standard deviations. The details are given as table 23.

Table 23

Cohen's d and Glass delta for Teaching Mathematics, MCK and Attitude towards Mathematics

Variable	Effect size	
Teaching Mathematics	Cohen's d	2.97
Mathematics Content Knowledge	Glass Delta	4.758
Attitude towards Mathematics	Glass Delta	2.929

Table 23 shows that the Cohen's d obtained for Teaching performance is 2.97 which is greater than .80, the value suggested by Cohen for large effect. The mean score of experimental group in Teaching Performance is 2.97 of a standard deviation higher than that of the control group mean. Hence the SLM developed by the investigator has a high effect on Teaching performance of D.Ed students.

The Glass delta obtained for Mathematics Content Knowledge is 4.758 which indicated a large effect. That is the experimental post-test mean score on Mathematics Content Knowledge is 4.758 standard deviation greater than that of the control group. Hence the SLM improved the Mathematics Content Knowledge of D.Ed students.

The delta value obtained in the case of Attitude towards Mathematics is 2.929 which again indicate a large effect. The post-test mean score on Attitude towards Mathematics of experimental group is 2.929 standard deviation higher than that of control group. Hence the SLM is effective to improve the attitude of D.Ed students towards Mathematics.

Conclusion

Analysis of data was done to find the extent of Mathematics Content Knowledge (MCK), Attitude towards Mathematics and Mathematics Aptitude among D.Ed students, to compare the pre-test mean scores on MCK, Attitude towards Mathematics and Mathematics Aptitude of experimental and control groups and to find the effect of the developed SLM on Teaching Mathematics, MCK and Attitude towards Mathematics of the prospective teachers.

After the preliminary analysis of data, it is found that the Mathematics Content Knowledge (MCK), Attitude towards Mathematics and Mathematics Aptitude of the prospective teachers were very low at the initial level of the D.Ed course. After the treatment, the experimental group has enhanced their Teaching, Mathematics Content Knowledge (MCK) and Attitude towards Mathematics compared to that of control group.

Both experimental and control groups are found to have negative attitude towards Mathematics before the experiment. After the treatment, both groups improved their attitude towards the subject, but when students using SLM developed a positive attitude towards Mathematics, the routine D.Ed. programme failed to attain this, though there is a slight improvement in the mean score. The present D.Ed programme improves the MCK and the teaching of students, but implementation of an SLM on the content and pedagogy improves remarkably the MCK, attitude towards the subject and teaching of D.Ed students.

When the influence of Mathematics Aptitude is statistically controlled, the variance between experimental and control groups has increased with respect to Teaching Mathematics, MCK and Attitude towards Mathematics.. The effect size was calculated using Cohen's d and Glass's delta, it was found that the SLM improved the teaching and Mathematics Content Knowledge of D.Ed students and it is effective to improve the attitude of D.Ed students towards Mathematics.

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Chapter 5

SUMMARY, CONCLUSION AND SUGGESTIONS

- *Study in Retrospect*
- *Major Findings*
- *Tenability of hypotheses*
- *Conclusion*
- *Educational Implications*
- *Suggestions for further Research*

Study in Retrospect

According to the suggestions of the Joint review Mission (2016) from MHRD, Pre-service teacher education needs suitable learning materials to improve the teaching skill especially in Science and Mathematics. A very heterogeneous class room and tight schedule of academic activities necessitate some individualized method to fill the gap for developing pedagogical competencies among student teachers. The need of such practices proliferates when it comes to the case of Mathematics. Hence in the present study, a self-learning module to make the D.Ed students improve their performance through content knowledge, positive attitude towards subject and skill based performance was constructed and validated. The study is entitled as "**Development of a Module to Enhance the Performance in Teaching Mathematics among Prospective Teachers at Primary Level**".

Variables of the study

In the present study, the treatment variable is the type of training for D.Ed students with two levels as implementation of the developed SLM on Mathematics together with the usual D.Ed programme for the experimental group and the usual D.Ed programme without the SLM for the control group.

The dependent variables in the study are Mathematics Content Knowledge, Attitude towards Mathematics and Teaching Mathematics which is coined together as performance in teaching Mathematics. Mathematics Aptitude is taken as the co-variate, the influence of which on dependent variables was controlled statistically.

Objectives of the study

The major objective of the study is to develop a self-learning module that is capable of enhancing the performance in teaching Mathematics of prospective teachers at primary level.

The following are the minor objectives set for the study.

1. To find out the extent of

    a) Mathematics Content Knowledge

    b) Attitude towards Mathematics

    c) Mathematics Aptitude among prospective teachers at primary level.

2. To compare the pre-test mean scores between control and experimental groups on

    a) Mathematics Content Knowledge

    b) Attitude towards Mathematics

    c) Mathematics Aptitude

3. To compare the pre-test and post-test mean scores of prospective teachers of both control and experimental groups on

    a) Mathematics Content Knowledge

    b) Attitude towards Mathematics

4. To compare the Post- test mean scores of prospective teachers of control and experimental groups on

    a) Mathematics Content Knowledge

    b) Attitude towards Mathematics.

5. To compare the mean gain scores of prospective teachers of control and experimental groups on

   a) Mathematics Content Knowledge

   b) Attitude towards Mathematics

6. To compare the mean score on Teaching Mathematics of prospective teachers of control and experimental groups

7. To test the influence of SLM on

   a) Mathematics Content Knowledge

   b) Attitude towards Mathematics

   c) The scores on Teaching Mathematics of prospective teachers

   when Mathematics Aptitude is taken as a co-variate.

8. To find out the effect size of the developed self-learning module on Mathematics Content Knowledge, Attitude towards Mathematics and the score on Teaching Mathematics of prospective teachers at primary level.

Methodology

Since the study was to construct and validate a Module on mathematics teaching, the investigator prepared a module with two sections one on the content and the other on its pedagogy. A survey was conducted to identify the level of MCK among D.Ed students. To validate the module investigator used a rating scale by which teacher educators rated the advantages of the module(digital form). More over the effectiveness of the module in enhancing MCK, Attitude towards mathematics and Teaching performance was empirically proved by testing the hypotheses formulated. For this, the investigator used quasi-experimental design with Pre-test- Post-test non-equivalent groups. The experimental group was 40 D. Ed students from DIET Palakkad and the control group was 40 D.Ed students from DIET, Malappuram. Their MCK was measured using a test on mathematics content knowledge constructed and standardized by the investigator. Attitude towards mathematics was measured using a scale on attitude towards mathematics and teaching performance was assessed by observation using an observation schedule. The pre-test and post-test mean scores on MCK and Attitude towards mathematics were compared. Teaching performance, MCK and Attitude towards mathematics of the experimental group was compared with that of the control group. Statistical techniques like test of significance of difference between two group means, ANCOVA and Cohen's d were used to test the hypotheses.

Major Findings

Statistical analysis of the data helped the investigator to arrive at the following findings.

1. Prospective teachers at primary level have a low level of Mathematics Content Knowledge at the entry level of their training programme (Mean= 25.13,, SD=7.43, Maximum score = 100)
2. Prospective teachers at primary level possess a negative Attitude towards Mathematics at the entry level (Mean = 84.23, SD =12.07, Neutral score=96)
3. Prospective teachers at primary level have low level of Mathematics Aptitude (Mean =29.78, SD= 6.91, Maximum score=67).
4. Experimental and control groups do not differ in their initial level of Mathematics Content Knowledge ($t = 1.704$, $p>.05$).

5. Experimental and control groups differ significantly in their initial level of Attitude towards Mathematics ($t = 4.341$, $p \leq .01$).
6. Both experimental and control groups have negative Attitude towards Mathematics at the entry level of their training programme. ($M_1=90.88$, $M_2=78.4$, $\sigma_1=13.717$, $\sigma_2=11.927$).
7. Experimental and control groups do not differ significantly in their initial level of Mathematics Aptitude ($t= .225$, $p>.05$).
8. The mean scores of the pre-test and post-test on MCK of the experimental group differ significantly ($t=18.236$, $p\leq .01$, $df=39$).
9. The mean scores of the pre-test and post-test on Attitude towards Mathematics of the experimental group differ significantly ($t= 13.611$, $p\leq .01$,$df=39$).
10. The difference in the pre-test and post-test mean scores of MCK of the control group is significant ($t= 5.94$, $p\leq.01$, $df=39$).
11. The difference in the pre-test and post-test mean scores of Attitude towards Mathematics of the control group is significant ($t=3.339$, $p\leq.01$, $df=39$).
12. Experimental and control groups differ significantly in their mean scores on Teaching Mathematics ($t=13.303$, $p\leq.01$).
13. Experimental and control groups differ significantly in their post test mean scores on Mathematics Content Knowledge.($t=14.282$, $p\leq .01$).
14. Experimental and control groups differ significantly in their post test mean scores on Attitude towards Mathematics. ($t=10.391$,$p\leq.01$).

15. The Experimental group has higher mean score in Mathematics Content Knowledge than the control group after the treatment. (M_1=34.65, M_2=13.95, σ_1=8.069,σ_2=4.35).
16. The mean score of Attitude towards Mathematics of the experimental group is higher than that of the control group after the treatment. (M_1=113.42, M_2=79.25, σ_1=17.221,σ_2=11.666).
17. The control group has a negative attitude towards the subject even after the D.Ed programme. (Mean=79.25,Neutral score=96).
18. The experimental group has positive attitude towards the subject after the treatment. (Mean=113.42,Neutral score=96).
19. Experimental and control groups differ significantly in the mean gain scores on MCK. ($t=16.583, P\leq.01$).
20. Experimental and control groups differ significantly in the mean gain scores on Attitude towards Mathematics ($t=12.946$, $P\leq.01$).
21. The experimental and control groups differ in their Teaching, irrespective of their Mathematics Aptitude. [$F=193.440, p\leq.01$, df=(1,79)]
22. The experimental and control groups differ in their post- test mean score on MCK, irrespective of their Mathematics Aptitude. [$F=209.004, p\leq.01$, df=(1,79)].
23. The experimental and control groups differ in their post-test mean score on Attitude towards Mathematics, irrespective of their Mathematics Aptitude [$F=109.443, p\leq.01$, df=(1,79)].
24. The mean score of experimental group in Teaching is 2.97 standard deviation higher than that of the control group (Cohen's d=2.97).

25. The experimental mean score on Mathematics Content Knowledge (post-test) is 4.758 standard deviation greater than that of the control group (Glass Delta=4.758).

26. The post test mean score on Attitude towards Mathematics of experimental group is 2.929 standard deviation higher than that of control group (Glass Delta=2.929).

Tenability of Hypotheses

Based on the finding of the study, the tenability of the hypotheses were tested.

Hypothesis 1. There is no significant difference in the pre-test mean scores on Mathematics Content Knowledge of control and experimental groups.

The critical ratio obtained is 1.704 (table 13) which indicates the difference in the pre-test mean scores on Mathematics Content Knowledge of experimental and control groups is not significant at .05 level of significance. Hence the first hypothesis is substantiated.

Hypothesis 2. There is no significant difference in the pre-test mean scores on Attitude towards Mathematics between control and experimental groups.

The critical ratio obtained is 4.341(table 13) which indicates a significant difference in the pre-test mean scores on Attitude towards Mathematics of control and experimental groups. Hence the second hypothesis is not substantiated.

Hypothesis 3. There is no significant difference in the pre-test mean scores on Mathematics Aptitude of control and experimental groups.

The critical ratio obtained is 0.225 (table 13) indicating the difference in the mean scores on Mathematics Aptitude of experimental and control groups as not significant at .05 level of significance . So the hypothesis is substantiated.

Hypothesis 4. There is significant difference in the pre-test and post-test mean scores on Mathematics Content Knowledge of the control group.

The critical ratio obtained is 5.94 (table 14) which indicates a significant difference in the pre -test and post- test mean scores of MCK of the Control group. Hence the hypothesis is substantiated.

Hypothesis 5. There is significant difference in the pre-test and post-test mean scores on Mathematics Content Knowledge of the experimental group.

The critical ratio obtained is 18.236 (table 14) which indicates significant difference in the mean scores of the pre- test and post- test on MCK of the experimental group. So the hypothesis is substantiated.

Hypothesis 6. There is significant difference in the pre-test and post-test mean scores on Attitude towards Mathematics of the control group.

The critical ratio obtained is 3.339 (table 14) which indicates a significant difference in the pre-test and post-test mean scores on Attitude towards Mathematics of the control group. Hence the hypothesis is substantiated.

Hypothesis 7. There is significant difference in the pre-test and post-test mean scores on Attitude towards Mathematics of the experimental group.

The critical ratio obtained is 13.611(table 14) which indicates significant difference in the pre- test and post- test mean scores on Attitude towards Mathematics of the experimental group. Hence the hypothesis is substantiated.

Hypothesis 8. There is significant difference in the mean scores on Teaching Mathematics of control and experimental groups

The critical ratio obtained is 13.303(table 15) which indicates significant difference in the mean scores on Teaching of control and experimental groups. So the hypothesis is substantiated.

Hypothesis 9. There is significant difference in the post-test mean scores on Mathematics Content Knowledge of control and experimental groups.

It is found that the difference in the post test mean scores on MCK of control and experimental groups is significant at .01 level as the critical ratio obtained is 14.282(table 15). Hence the hypothesis is substantiated.

Hypothesis 10. There is significant difference in the post-test mean scores on Attitude towards Mathematics of control and experimental groups.

It is found that the difference in the post test mean scores on Attitude towards Mathematics of control and experimental groups is significant at .01 level as the critical ratio obtained is 10.391(table 15). Hence the hypothesis is substantiated.

Hypothesis 11. There is significant difference in the mean gain scores on Mathematics Content Knowledge of control and experimental groups.

The critical ratio obtained is 16.583 (table 16) which indicates significant difference in the mean gain scores on Mathematics Content Knowledge of control and experimental groups. Hence the hypothesis is substantiated.

Hypothesis 12. There is significant difference in the mean gain scores on Attitude towards Mathematics of control and experimental groups.

It is found that the difference in the gain scores on Attitude towards Mathematics is significant at .01 level as the critical ratio obtained is 12.946 (table 16). So the hypothesis is substantiated.

Hypothesis 13. There is significant mean difference in Mathematics Content Knowledge between control and experimental groups when Mathematics Aptitude is taken as a co-variate.

The F value obtained is 209.004 (table 20) which indicates significant difference in the post test mean score on Mathematics Content Knowledge of the experimental and control groups when Mathematics Aptitude is taken as a co-variate. Hence the hypothesis is substantiated.

Hypothesis 14. There is significant mean difference in Attitude towards Mathematics between control and experimental groups when Mathematics Aptitude is taken as a co-variate.

The F value obtained is 109.433 (table 22) indicates significant difference in their post- test mean score on Attitude towards Mathematics of the experimental and control groups when Mathematics Aptitude is taken as a co-variate. So the hypothesis is substantiated.

Hypothesis 15. There is significant mean difference in Teaching Mathemtics of prospective teachers between control and experimental groups when Mathematics Aptitude is taken as a co-variate

The F value obtained is 193.440 (table 18) which indicates significant difference in their post-test mean score on Teaching of the experimental and control groups when Mathematics Aptitude is taken as a co-variate. So the hypothesis is substantiated.

Hypothesis 16. The post-test mean scores on Teaching Mathematics, Mathematics Content Knowledge and Attitude towards Mathematics of Experimental group are significantly higher than that of control group.

The Cohen's d and Glass Delta values obtained in the case of Teaching, Mathematics Content Knowledge and Attitude towards Mathematics (d=2.97, Δ=4.758,Δ=2.929 from table 23) reveal that the developed SLM has significant high effect on Teaching, Mathematics Content Knowledge and Attitude towards Mathematics. Hence post-test mean scores on Teaching, Mathematics Content Knowledge and Attitude towards Mathematics of Experimental group are significantly higher than that of control group. Thus, the hypothesis is substantiated.

Conclusion

The initial level of the experimental and control groups in Mathematics Content Knowledge and Mathematics Aptitude are found to be the same where as that of Attitude towards Mathematics is higher for experimental group. But both groups have negative attitude towards Mathematics, though mean score of experimental group is significantly higher than that of control group. Hence this difference in Attitude towards Mathematics will not affect the validity of the experiment. The mean scores of post- tests and gain scores on Mathematics Content Knowledge and Attitude towards Mathematics of experimental and control groups differ significantly favouring the experimental group. The mean score on Teaching Mathematics of experimental and control groups differ significantly. When Mathematics Aptitude is controlled statistically the experimental and control groups are found to differ significantly in the mean post-test scores on Teaching Mathematics, MCK and Attitude towards Mathematics. The developed SLM is found to have high effect on Teaching, Mathematics Content Knowledge and Attitude towards Mathematics. This evidently points out the effectiveness of the SLM for promoting the MCK, Attitude towards Mathematics and Teaching of prospective teachers in Mathematics at primary level.

Educational Implications

The Mathematics Content Knowledge (MCK) of the Diploma in Education (D.Ed) students under study was found to be very low. At present, students of D.Ed course are forced to teach all the subjects viz., Mother tongue, English, Environmental science, Social science, Mathematics, Art education, Physical education, Health education and ICT during their internship as per the curriculum norms. At the same time, they are basically from different disciplines. Though these subjects are learnt at school level, they might have forgotten the basics of these subject, or there may be gaps in learning various aspects. There are even chances for misconceptions related to not only the basics but also about the factual and conceptual aspects. In this circumstance it is essential to improve the content knowledge related to all the subjects especially in Mathematics which will lead to quality improvement in teacher education. Hence the investigator recommends the curriculum committee to include a Core course on the basics of all the school subjects in the first semester of the D.Ed as well as D.El.Ed courses.

The study reveals that the experimental group has improved the MCK, Attitude towards Mathematics and Teaching Mathematics. But at the same time control group has improved same. A close observation of the two groups make it clear that student who used SLM together with the D.Ed. programme have improved their MCK, remarkably changed the negative to positive attitude towards subject and improved the teaching. But students who have undergone the D.Ed. programme, the content knowledge and teaching have improved a litte.; attitude changed, but still negative.

So teacher educators should be motivated to prepare such SLS and encourage students to use the same to enrich the DEd. pgoramme.

Before entering into the discussions on pedagogical aspects of each subject, teacher educators should focus on ensuring the content knowledge among the prospective teachers. This can be done by arranging seminars, discussions or providing assignments and the like. Also teachers can prepare SLM on difficult areas using technological platforms like moodle, cousera, eduncle, study nation, Siksha, Aglasem, india-edu etc.

In the study, D.Ed students are found to have negative attitude towards mathematics, but when the SLM was implemented, they developed a positive attitude towards the subject. The change is really prominent when it is observed in a situation where the D.Ed programme failed to do so. A mathematics teacher with negative attitude towards the subject will surely have negative influence on the performance of students during the early years of schooling. Here the attitude, and performance of the teacher have a crucial role in molding the students to the expected levels. Hence to improve the quality of school education, the attitude of student teachers towards the subject must be improved considerably. Special attempts must be taken by teacher educators to improve the same. During the teacher education programme more chances must be given to students for participating in various activities of subjects clubs, workshops, demonstration, field visits and presentations. Efforts are also needed to eliminate inhibitions and to make the learning of the subject more entertaining, fearless and rejoicing. Each activity must be meaningful to the learner.

Even though the school education in Kerala underwent qualitative revisions during the past three decades, the teaching and learning of Mathematics at primary level is not so attractive and hopeful (National Achievement Survey (NAS), 2015). One of the main reasons for this state of affairs may be the existence of negative attitude towards the subject among the students during schooling. To develop a positive attitude, practicing teachers should adopt interesting and effective strategies for teaching the subject. Art integrated, technology based, activity oriented and game based attempts can be undertaken by the teachers in order to inculcate and ensure positive attitude towards the subject. Apart from using the conventional tools for evaluating the performance in Mathematics, informal techniques of assessment could be used.

A variety of experiences are to be imparted during the pre-service training period itself. Hence there is a need for enriching D.Ed curriculum accordingly. The SLM prepared was found to be effective for improving teaching mathematics, Attitude towards Mathematics and Mathematics Content Knowledge. Workshops may be organised by the authorities to prepare such learning materials for various subjects. Printed as well as technology based programs are to be developed for prospective teachers on relevant topics.

On-line education platforms like Moodle, Eduncle, India edu should be initiated by the teacher education institutions in both content and pedagogical areas and that too for promoting self-learning. Annual academic plan of the institutions should be revised by giving due importance and space for including these kinds of on-line programmes.

Self-learning modules(SLM) always promote interest, attitude and confidence level of the prospective teachers in the subject. In this circumstance it is essential to ensure spread of using such materials for enhancing the performance of prospective teachers in teaching other subjects too. At present, there is no prescribed text book for D.Ed course. It may adversely affects the total performance of the prospective teachers. In this context, the use of self-learning modules(SLM) related to the subject becomes more significant.

The findings of the study provide sense of direction to the planners of the department and policy makers, projects and curriculum developers in the areas of material development, training and evaluation process pertaining to pre-service and in-service teacher education.

Suggestions for further research

1. Even though SLM was developed in all the six content areas, the area 'fraction' was considered for developing self-learning module at pedagogic level to the prospective teachers. Since the result showed high impact among the target group, other areas of the content viz., Percentage, Decimal numbers, Ratio & Proportion, Geometry and Algebra have also to be considered for developing pedagogic modules which could create high level performance in teaching mathematics.
2. The sample of the present study was taken from two government institutes of two districts in the state of Kerala. Studies could be conducted on a sample covering other institutions and districts.
3. It is desirable to develop on-line self-learning modules along with conventional ones considering the emerging trends in the field of education.
4. The initiative taken by the researcher in the area of mathematics created a positive spirit among the prospective teachers especially in their teaching performance. Attempts could be made developing and using SLM in other subjects based on need and requirement in the area concerned.

5. D.Ed students are found to have low level of content knowledge in Mathematics in their entry level to the teacher education programe. Survey on the level of content knowledge in other relevant subjects are recommended.
6. A survey on the attitude of in-service teachers towards various subjects is also recommended as it will lead to improve the existing school education.

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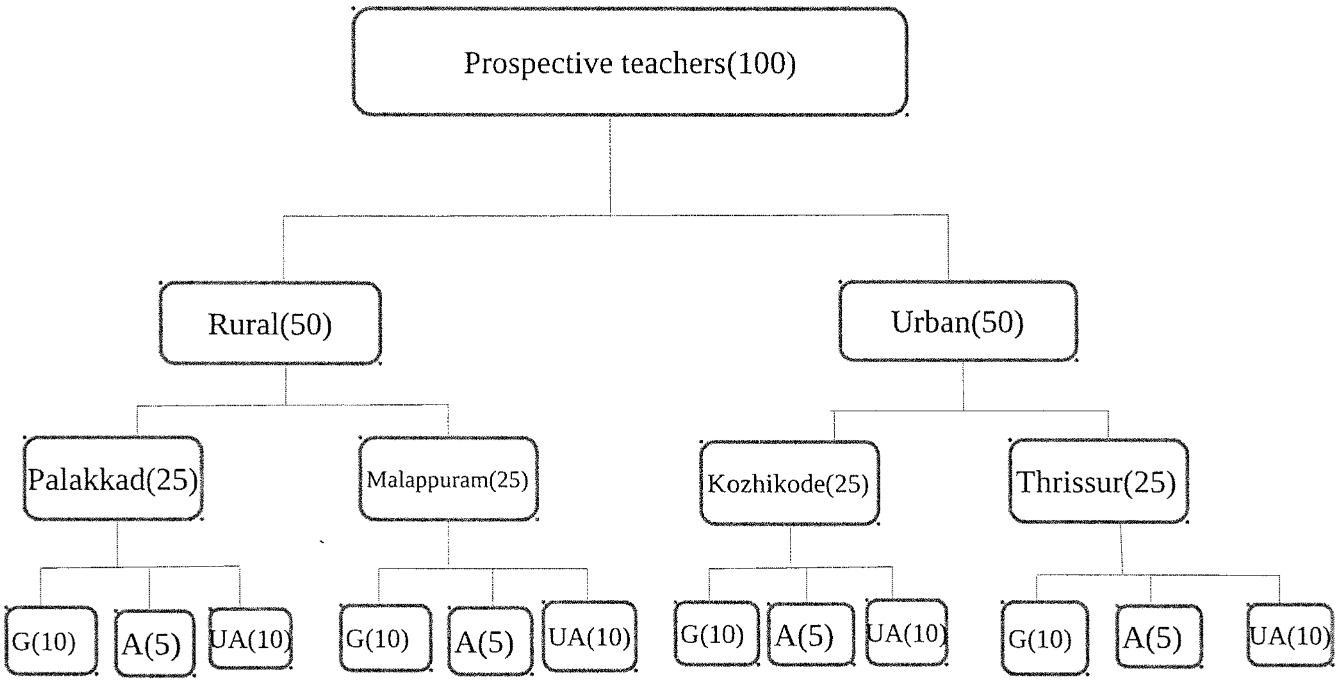
APPENDICES

Appendix A

Details of Prospective teachers participated in the survey



Appendix B

FAROOK TRAINING COLLEGE

Research Centre in Education

University of Calicut

SCALE OF ATTITUDE TOWARDS MATHEMATICS (Draft)

M. Saheed Ali
Research Scholar

Dr. K. Vijayakumari
Associate Professor
Farook Training College

നിർദ്ദേശങ്ങൾ

ഗണിതശാസ്ത്രത്തെക്കുറിച്ച് നിങ്ങളുടെ മനോഭാവം അറിയാനുള്ള 40 പ്രസ്താവനകളാണ് ഇതോടൊന്നിച്ച് നൽകുന്നത്.

ഓരോ പ്രസ്താവനയും വായിച്ചശേഷം അതിനെക്കുറിച്ചുള്ള നിങ്ങളുടെ പ്രതികരണം 'ശക്തിയായി യോജിക്കുന്നു', 'യോജിക്കുന്നു', 'അഭിപ്രായമില്ല', 'വിയോജിക്കുന്നു', 'ശക്തിയായി വിയോജിക്കുന്നു' എന്ന രീതിയിലാണ് രേഖപ്പെടുത്തേണ്ടത്. ഇതിനായി പ്രസ്താവനകൾക്ക് താഴെ SA (Strongly Agree ശക്തിയായി യോജിക്കുന്നു), A (Agree യോജിക്കുന്നു), U (Undecided അഭിപ്രായമില്ല / നിഷ്പക്ഷത പാലിക്കുന്നു), D (Disagree വിയോജിക്കുന്നു), SD (Strongly Disagree ശക്തിയായി വിയോജി ക്കുന്നു) എന്നിങ്ങനെ രേഖപ്പെടുത്തിയിട്ടുണ്ട്. നിങ്ങളുടെ പ്രതികരണം ☐ എന്ന ചിഹ്നം ഉപയോഗിച്ച് അടയാളപ്പെടുത്തുക.

ഉദാ: ഗണിതപ്രശ്നങ്ങളാണ് ശാസ്ത്രവിഷയങ്ങളെ രസകരമാക്കുന്നത്.

SA	A	U	D	SD
☑	☐	☐	☐	☐

ഈ ഉദാഹരണത്തിൽ SA എന്ന കോളത്തിലുള്ള ചതുരത്തിലാണ് അടയാളം ഇട്ടിരിക്കുന്നത്. ഉത്തരം എഴുതുന്ന ആൾ ഈ പ്രസ്താവനയോട് പരിപൂർണ്ണമായി യോജിക്കുന്നു എന്നാണ് ഇത് സൂചിപ്പിക്കുന്നത്.

ഇനി ഓരോ പ്രസ്താവനയും വായിച്ച് തന്നിരിക്കുന്ന Response Sheet ൽ നിങ്ങളുടെ പ്രതികരണം പ്രസ്താവനകളുടെ നമ്പറിന് നേരെ ***ടിക്*** ചെയ്യുക

1. ഗണിതശാസ്ത്രം ജീവിത വിജയത്തിൽ അത്യാന്താപേക്ഷിതമാണ്.
2. സമൂഹത്തിന്റെ പുരോഗതിക്ക് ഗണിതശാസ്ത്രം വലിയ സംഭാവനകൾ നൽകിയിട്ടുണ്ട്.
3. ഗണിതശാസ്ത്ര പുരോഗതികൊണ്ട് ഉണ്ടാകുന്ന നേട്ടങ്ങൾ സമൂഹത്തിന് ഗുണപ്രദമാണ്.
4. ഗണിതശാസ്ത്രം പഠിച്ചവർക്ക് ജോലി സമ്പാദിക്കുവാൻ എളുപ്പമാണ്.
5. ഗണിതപഠനംമൂലം അന്ധവിശ്വാസങ്ങൾ ഇല്ലാതാകുന്നു.
6. ഗണിതക്ലബ്ബ് പ്രവർത്തനങ്ങൾക്ക് ചെലവഴിക്കുന്ന സമയം നഷ്ടമാണ് .
7. ഗണിതശാസ്ത്രം പഠിക്കുന്നതിന് അസാധാരണ ബുദ്ധി ആവശ്യമില്ല.
8. ഗണിതപ്രശ്നങ്ങളെ സംബന്ധിച്ചുള്ള സംശയങ്ങൾ ഉടനടി നിവാരണം നടത്തേണ്ടതാണ്.
9. മറ്റു വിഷയങ്ങൾ പഠിക്കാൻ ഗണിതശാസ്ത്രം സഹായിക്കുന്നു.
10. ഗണിതപ്രശ്നം നിർദ്ദാരണം ചെയ്യുമ്പോൾ ഞാനതിൽ പൂർണ്ണമായി മുഴുകാറുണ്ട്.
11. കഠിനവും വിരസവും ആയതിനാൽ ഗണിതക്ലാസ്സുകൾ ഞാൻ ശ്രദ്ധിക്കാറില്ല.
12. കണക്ക് ക്ലാസ്സിൽ പഠിപ്പിക്കുമ്പോൾ ഭാഗങ്ങൾ ഹൃദ്യസ്ഥമാക്കാൻ അന്നുതന്നെ ബന്ധപ്പെട്ട പ്രശ്നങ്ങൾ നിർദ്ദാരണം ചെയ്യാറുണ്ട്.
13. നിത്യജീവിതത്തിൽ പ്രയോജനപ്പെടുമെന്നുള്ളതുകൊണ്ടാണ് ഞാൻ കണക്ക് പഠിക്കുന്നത്.
14. ഗണിതത്തിൽ ഉന്നതവിജയം നേടുന്നവരെ സമൂഹം ആദരിക്കുന്നതിനാൽ പ്രസ്തുത വിഷയം പഠിക്കുവാൻ എനിക്ക് താത്പര്യമാണ്.
15. ഗണിതാധ്യാപകർ ശ്രേഷ്ഠരാണ്.
16. ഗണിതപഠനം യുക്തിചിന്തയെ പ്രോത്സാഹിപ്പിക്കുന്നു.
17. കണക്ക് പഠിക്കാൻ എനിക്ക് താത്പര്യമാണ്.
18. ഗണിതശാസ്ത്ര ക്ലാസുകൾ എത്ര രസകരമായാലും ഞാൻ ശ്രദ്ധിക്കാറില്ല.
19. സ്വന്തമായി ഗണിതപ്രശ്നങ്ങൾ ചെയ്താൽ തെറ്റുപറ്റിയാലോ എന്ന് കരുതി ഞാൻ പ്രശ്നങ്ങൾ ഒന്നും ചെയ്യാറില്ല.
20. ഗണിതശാസ്ത്രജ്ഞൻമാരുടെ ജീവചരിത്രം കുട്ടികളിൽ കണക്ക് പഠിക്കുവാനുള്ള അഭിപ്രേരണക്ക് കാരണമാകുന്നു.
21. ഗണിതശാസ്ത്രസംബന്ധമായ പാഠ്യേതര പ്രശ്നങ്ങൾ ചെയ്യാൻ ഞാൻ ശ്രമിക്കാറില്ല.
22. മാന്ത്രികചതുരം നിർമ്മിക്കുന്നതും പസിലുകൾ ചെയ്യുന്നതും എന്റെ വിശ്രമസമയ വിനോദമാണ്.

23. ഗണിത തത്ത്വങ്ങൾ അടിസ്ഥാനമാക്കിയുള്ള കടംകഥകൾക്ക് ഉത്തരം കണ്ടെത്താൻ ഞാൻ ശ്രമിക്കാറില്ല.

24. ഗണിതത്തിൽ മിടുക്കരായ കുട്ടികളോട് എനിക്ക് ആരാധനയാണ്.

25. ഗണിതാശയങ്ങൾ ദൈനംദിനജീവിതത്തിന് അത്യന്താപേക്ഷിതമാണ്.

26. ഗണിത സംബന്ധമായ ഒരു സംശയവും ഞാൻ നിവാരണം ചെയ്യാറില്ല .

27. ഗണിതത്തിലെ ജ്യാമിതീയ രൂപങ്ങൾക്ക് പ്രത്യേകിച്ച് ഭംഗിയൊന്നുമില്ല

28. ഗണിതശാസ്ത്രത്തിൽ അടിസ്ഥാന വിവരമില്ലാത്തവർക്കും ജീവിതത്തിൽ ശോഭിക്കാൻ കഴിയും.

29. ഏത് തൊഴിൽ മേഖലയിലുള്ളവർക്കും നിർബന്ധമായും ഗണിതജ്ഞാനം ആവശ്യമാണ്.

30. ഗണിതശാസ്ത്രത്തിലെ പ്രയാസമേറിയ പ്രശ്നങ്ങൾ ക്ഷമയോടെ പരിഹരിക്കുന്ന ഒ രാൾക്ക് ജീവിതത്തിലെ പ്രശ്നങ്ങളും ക്ഷമാപൂർവ്വം പരിഹരിക്കാൻ കഴിയും.

31. കണക്കിനോട് ആഭിമുഖ്യമുള്ളവർക്ക് നിത്യജീവിതത്തിലെ മറ്റുകാര്യങ്ങളിലും സൂക്ഷ്മത ഉണ്ടാകാനിടയുണ്ട്.

32. ഗണിതപഠനം കലാ പഠനത്തെ സഹായിക്കുന്നു.

33. സാംസ്ക്കാരിക പുരോഗതിയിൽ ഗണിതശാസ്ത്രത്തിന് പ്രത്യേക സ്ഥാനമൊന്നുമില്ല.

34. ഗണിതശാസ്ത്ര കണ്ടെത്തലുകൾ എല്ലാ രാജ്യക്കാർക്കും പ്രയോജനപ്രദമാണ്.

35. ഇന്നത്തെ കാലത്ത് ഒരു വ്യക്തിയുടെ നിലനിൽപ്പിന് ഗണിതം അത്യന്താപേക്ഷിതമാണ്.

36. ഗണിതശാസ്ത്രത്തിന് രാഷ്ട്രാതീത സ്വഭാവമാണുള്ളത് .

37. കലാരൂപങ്ങളുടെ നിർമ്മിതിയിൽ ഗണിതം പ്രയോജനപ്പെടുന്നു.

38. മാനവരാശിയുടെ പുരോഗതിക്ക് അടിസ്ഥാനം നൽകുന്നത് ഗണിതശാസ്ത്രമാണ്.

39 ഗണിതശാസ്ത്രം സാധാരണ കുട്ടികൾക്ക് യോജിച്ചതല്ല.

40. തെറ്റുപറ്റിയാലോ എന്നു കരുതി ഗണിതപ്രവർത്തനങ്ങളൊന്നും തന്നെ ഞാൻ ചെയ്യാൻ ശ്രമിക്കാറില്ല.

Appendix C1

FAROOK TRAINING COLLEGE

Research Centre in Education

University of Calicut

SCALE OF ATTITUDE TOWARDS MATHEMATICS (Final)

M. Saheed Ali
Research Scholar

Dr. K. Vijayakumari
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നിർദ്ദേശങ്ങൾ

ഗണിതശാസ്ത്രത്തെക്കുറിച്ച് നിങ്ങളുടെ മനോഭാവം അറിയാനുള്ള 40 പ്രസ്താവനകളാണ് ഇതോടൊന്നിച്ച് നൽകുന്നത്.

ഓരോ പ്രസ്താവനയും വായിച്ചശേഷം അതിനെക്കുറിച്ചുള്ള നിങ്ങളുടെ പ്രതികരണം 'ശക്തിയായി യോജിക്കുന്നു', 'യോജിക്കുന്നു', 'അഭിപ്രായമില്ല', 'വിയോജിക്കുന്നു', 'ശക്തിയായി വിയോജിക്കുന്നു' എന്ന രീതിയിലാണ് രേഖപ്പെടുത്തേണ്ടത്. ഇതിനായി പ്രസ്താവനകൾക്ക് താഴെ SA (Strongly Agree ശക്തിയായി യോജിക്കുന്നു), A (Agree യോജിക്കുന്നു), U (Undecided അഭിപ്രായമില്ല / നിഷ്പക്ഷത പാലിക്കുന്നു), D (Disagree വിയോജിക്കുന്നു), SD (Strongly Disagree ശക്തിയായി വിയോജി ക്കുന്നു) എന്നിങ്ങനെ രേഖപ്പെടുത്തിയിട്ടുണ്ട്. നിങ്ങളുടെ പ്രതികരണം ☐ എന്ന ചിഹ്നം ഉപയോഗിച്ച് അടയാളപ്പെടുത്തുക.

ഉദാ: ഗണിതപ്രശ്നങ്ങളാണ് ശാസ്ത്രവിഷയങ്ങളെ രസകരമാക്കുന്നത്.

SA	A	U	D	SD
☑	☐	☐	☐	☐

ഈ ഉദാഹരണത്തിൽ SA എന്ന കോളത്തിലുള്ള ചതുരത്തിലാണ് അടയാളം ഇട്ടിരിക്കുന്നത്. ഉത്തരം എഴുതുന്ന ആൾ ഈ പ്രസ്താവനയോട് പരിപൂർണ്ണമായി യോജിക്കുന്നു എന്നാണ് ഇത് സൂചിപ്പിക്കുന്നത്.

ഇനി ഓരോ പ്രസ്താവനയും വായിച്ച് തന്നിരിക്കുന്ന Response Sheet ൽ നിങ്ങളുടെ പ്രതികരണം പ്രസ്താവനകളുടെ നമ്പറിന് നേരെ ***ടിക്*** ചെയ്യുക

1. ഗണിതശാസ്ത്രം ജീവിത വിജയത്തിൽ അത്യന്താപേക്ഷിതമാണ്.

2. ഗണിതശാസ്ത്രം പഠിച്ചവർക്ക് ജോലി സമ്പാദിക്കാൻ എളുപ്പമാണ്.

3. ഗണിതപഠനംമൂലം അന്ധവിശ്വാസങ്ങൾ ഇല്ലാതാകുന്നു.

4. ഗണിതശാസ്ത്രം പഠിക്കുന്നതിന് അസാധാരണ ബുദ്ധി ആവശ്യമില്ല

5. മറ്റു വിഷയങ്ങൾ പഠിക്കാൻ ഗണിതശാസ്ത്രം സഹായിക്കുന്നു.

6. ഗണിതശാസ്ത്രം നിർദ്ദാരണം ചെയ്യുമ്പോൾ ഞാനതിൽ പൂർണ്ണമായി മുഴുകാറുണ്ട്

7. കഠിനവും വിരസവും ആയതിനാൽ ഗണിതക്ലാസ്സുകൾ ഞാൻ ശ്രദ്ധിക്കാറില്ല.

8. കണക്ക് ക്ലാസ്സിൽ പഠിപ്പിക്കുമ്പോൾ ഭാഗങ്ങൾ ഹൃദ്യസ്ഥമാക്കാൻ അന്നു തന്നെ ബന്ധപ്പെട്ട പ്രശ്നങ്ങൾ നിർദ്ദാരണം ചെയ്യാറുണ്ട്.

9. നിത്യജീവിതത്തിൽ പ്രയോജനപ്പെടുമെന്നുള്ളതുകൊണ്ടാണ് ഞാൻ കണക്ക് പഠിക്കുന്നത്.

10. ഗണിതത്തിൽ ഉന്നതവിജയം നേടുന്നവരെ സമൂഹം ആദരിക്കുന്നതിനാൽ പ്രസ്തുത വിഷയം പഠിക്കുവാൻ എനിക്ക് താല്പര്യമാണ്.

11. ഗണിതാധ്യാപകൻ ശ്രേഷ്ഠരാണ്.

12. ഗണിതപഠനം യുക്തിചിന്തയെ പ്രോത്സാഹിപ്പിക്കുന്നു.

13. കണക്ക പഠിക്കാൻ എനിക്ക് താല്പര്യമാണ്.

14. ഗണിതശാസ്ത്ര ക്ലാസ്സുകൾ എത്ര രസകരമായാലും ഞാൻ ശ്രദ്ധിക്കാറില്ല.

15. സ്വന്തമായി ഗണിതപ്രശ്നങ്ങൾ ചെയ്താൽ തെറ്റുപറ്റിയാലോ എന്ന് കരുതി ഞാൻ പ്രശ്നങ്ങൾ ഒന്നും ചെയ്യാറില്ല.

16. ഗണിതശാസ്ത്രശാസ്ത്രജ്ഞൻമാരുടെ ജീവചരിത്രം കുട്ടികളിൽ കണക്ക് പഠിക്കുവാനുള്ള അഭിപ്രേരണക്ക് കാരണമാകുന്നു.

17. ഗണിതശാസ്ത്രസംബന്ധമായ പാഠ്യേതര പ്രശ്നങ്ങൾ ചെയ്യാൻ ഞാൻ ശ്രദ്ധിക്കാറില്ല.

18. മാന്ത്രികചതുരം നിർമ്മിക്കുന്നതും പസിലുകൾ ചെയ്യുന്നതും എന്റെ വിശ്രമ സമയ വിനോദമാണ്.

19. ഗണിത തത്ത്വങ്ങൾ അടിസ്ഥാനമാക്കിയുള്ള കടംകഥകൾക്ക് ഉത്തരം കണ്ടെത്താൻ ഞാൻ ശ്രമിക്കാറില്ല.

20. ഗണിതത്തിൽ മിടുക്കരായ കുട്ടികളോട് എനിക്ക് ആരാധനയാണ്.

21. ഗണിത സംബന്ധമായ ഒരു സംശയവും ഞാൻ നിവാരണം ചെയ്യാറില്ല.

22. ഗണിതത്തിലെ ജ്യാമിതീയ രൂപങ്ങൾക്ക് പ്രത്യേകിച്ച് ഭംഗിയൊന്നുമില്ല.

23. ഗണിതശാസ്ത്രത്തിൽ അടിസ്ഥാന വിവരമില്ലാത്തവർക്കും ജീവിതത്തിൽ ശോഭിക്കാൻ കഴിയും.

24. ഏത് തൊഴിൽ മേഖലയിലുള്ളവർക്കും നിർബന്ധമായും ഗണിതജ്ഞാനം ആവശ്യമാണ്.

25. ഗണിതശാസ്ത്രത്തിലെ പ്രയാസമേറിയ പ്രശ്നങ്ങൾ ക്ഷമയോടെ പരിഹരിക്കുന്ന ഒരാൾക്ക് ജീവിതത്തിലെ പ്രശ്നങ്ങളും ക്ഷമാപൂർവ്വം പരിഹരിക്കാൻ കഴിയും.

26. കണക്കിനോട് ആഭിമുഖ്യമുള്ളവർക്ക് നിത്യജീവിതത്തിലെ മറ്റു കാര്യങ്ങളിലും സൂക്ഷ്മത ഉണ്ടാകാനിടയുണ്ട്.

27. ഗണിതപഠനം കലാ പഠനത്തെ സഹായിക്കുന്നു.

28. സാംസ്കാരിക പുരോഗതിയിൽ ഗണിതശാസ്ത്രത്തിൽ പ്രത്യേക സ്ഥാനമൊന്നുമില്ല.

29. ഗണിതശാസ്ത്ര കണ്ടെത്തലുകൾ എല്ലാ രാജ്യക്കാർക്കും പ്രയോജനപ്രദമാണ്.

30. കലാരൂപങ്ങളുടെ നിർമ്മിതിയിൽ ഗണിതം പ്രയോജനപ്പെടുന്നു.

31. മാനവരാശിയുടെ പുരോഗതിക്ക് അടിസ്ഥാനം നൽകുന്നത് ഗണിതശാസ്ത്രമാണ്.

32. ഗണിതശാസ്ത്രം സാധാരണ കുട്ടികൾക്ക് യോജിച്ചതല്ല.

FAROOK TRAINING COLLEGE

Research Centre in Education
University of Calicut

SCALE OF ATTITUDE TOWARDS MATHEMATICS(Final)

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Instructions

Below are the given 40 statements to know about your attitude towards mathematics. You are request to read each of the statements and to mark your response as 'Strongly agree','Agree', 'Undecided, Disagree and Strongly disagree as the case may be. For this, abbreviations such as SA(Strongly agree),A(Agree),U(Undecided), D(Disagree) and SD(Strongly disagree) are marked out. Kindly mark your responses using the mark √ accordingly.

Eg:-Mathematical problems make the science subjects interesting

SA	A	U	D	SD
✓				

In the above example √ tick mark is given in the column SA. This indicates the perfect agreement of the respondent towards this statement.

Now read each of the statements and mark your responses against the number which denotes the statement.

1. Mathematics is quite essential for the success in life.
2. It is easy to get job those learnt mathematics
3. Superstitions get washed away through mathematics learning
4. There is no need of high intelligence for learning mathematics
5. Mathematics helps to learn the other subjects
6. While solving mathematical problems, I get fully involved in it.
7. I don't attend the mathematics classes since they are tough and dull
8. While learning mathematics, I used to solve the related problems on the same day itself for learning them by heart.

9. I learn mathematics as it is useful in daily life.

10. I feel interest to learn mathematics since the high achievers in the subject are being recognized by the society.

11. Mathematics teachers are noble.

12. Learning of mathematics encourages the logical thinking.

13. I am interested in learning mathematics

14. I don't listen mathematics classes however it is interesting

15. I don't solve mathematical problems because of thinking about committing errors

16. The biography of mathematicians promotes motivation among students to learn mathematics

17. I don't attempt to solve the co-curricular problems in connection with mathematics.

18. Constructing magic squares and solving puzzles are my hobbies.

19. I don't attempt to find the answers of puzzles based on mathematical principles

20. I admire the students who excel in mathematics

21. I don't clear any doubts which related to mathematics.

22. The geometric figures of mathematics do not have any specific beauty.

23. Those with no basic knowledge in mathematics can shine in their life .

24. Mathematics knowledge is essential to all people who are working with any job.

25. Those who solve mathematical problems very patiently, can solve the life problems with the same patience.

26. Those who have ability in mathematics keep its preciseness in life too.

27. Mathematics learning helps the learning of Art.

28. Mathematics has no role in the cultural development.

29. The findings of mathematics are useful to people of all countries

30. Mathematics is useful in the creation of art forms.

31. Mathematics is the basis for the development of human being.

32. Mathematics is not suitable to normal students.

Appendix D

Test of Mathematics Aptitude (Sumangala & Malini, 1996)

TEST 1 - NUMERICAL ABILITY

Instructions: (നിർദ്ദേശങ്ങൾ)

നിങ്ങൾ ഇതുവരെ പഠിച്ചിട്ടുള്ള തത്വങ്ങളെ ആധാരമാക്കി ഗണിതശാസ്ത്രത്തിലെ വിവിധ തരത്തിലുള്ള പ്രശ്നങ്ങൾ തന്നിരിക്കുന്നു അവയോടൊപ്പം 4 ഉത്തരങ്ങൾ വീതവും തന്നിട്ടുണ്ട്. ഓരോന്നിന്റെയും ശരിയുത്തരം കണ്ടുപിടിച്ച് പ്രത്യേകം തന്നിട്ടുള്ള ഉത്തരക്കടലാസിൽ 'X' അടയാളമിട്ട് രേഖപ്പെടുത്തുക.

മാതൃക

(i) 87 + 128 + 55 = ____________

Ans : A. 370 B. 270 C. 260 D. 380

മുകളിൽ കൊടുത്തിരിക്കുന്ന ചോദ്യത്തിന്റെ ഉത്തരം 270 ആണ്. ഇത് Bയുടെ നേരെയുള്ള ഉത്തരമാണല്ലോ. അതിനാൽ ഉത്തരക്കടലാസിൽ Bയുടെ താഴെയുള്ള വൃത്തത്തിൽ 'X' ഇട്ടിരിക്കുന്നു.

A B C D

O O O O

(ആവശ്യപ്പെടുമ്പോൾ മാത്രം ചെയ്തു തുടങ്ങുക)

സമയം : 25 മിനിറ്റ്

---

1. $4725 - 666 + 3275 =$ ____________
   A. 8444 B. 7334 C. 7444 D. 8666

2. $0.1 + 0.011 + 0.1010 =$ ____________
   A. 0.2120 B. 0.1220 C. 0.1202 D. 0.2102

3. $32.6 + 12.6 -$ _______ $= 25$
   A. 20 B. 20.1 C. 20.2 D. 22

4. $34 + 4 \div 9 \times 9 - 3 =$ ____________
   A. 30 B. 35 C. $25\frac{1}{3}$ D. $2\frac{3}{20}$

5. $\frac{3}{4} - 1\frac{1}{4} + 2\frac{5}{4} =$ ________
   A. $\frac{9}{4}$ B. $\frac{7}{4}$ C. $\frac{11}{4}$ D. $\frac{5}{4}$

6. ഏറ്റവും ചെറിയ നാലക്ക സംഖ്യ
   A. 0124 B. 1024 C. 1042 D. 1204

7. $2.25 \div$ _________ $= 1.5$
   A. 3.5 B. 0.5 C. 1.5 D. 0.25

8. $\left(\frac{3}{4} \div \frac{9}{4}\right) \times \frac{27}{4} =$ ______
   A. $\frac{3}{4}$ B. $\frac{9}{4}$ C. $\frac{4}{3}$ D. $\frac{4}{9}$

9. $0.002 \times$ ________ $= 200$

A. 100 B. 1000 C. 10000 D. 100000

10. (__________)^3 $= 0.064$

A. 4 B. 0.4 C. 0.04 D. 0.004

11. $(0.25 \div 5) \times 5 - 0.05 =$ __________

A. 0.15 B. 0.25 C. 0.2 D. 0.05

12. (______ $\div 8) - 8 = 0$

A. 80 B. 8 C. 64 D. 48

13. $3 \div \sqrt{3} =$ ______

A. $\sqrt{3}$ B. $3\sqrt{3}$ C. $(\sqrt{3})^2$ D. $\frac{1}{\sqrt{3}}$

14. 5^3 _____ 5^2 = _______

A. 100 B. 5 C. 25 D. 50

15. $\frac{1}{20}$ നെ ശതമാനമാക്കുമ്പോൾ

A. 5% B. 10% C. 20% D. 40%

16. $0.65 \times$ _____ $= 0.6565$

A. 101 B. 0.101 C. 1.10 D. 1.01

17. $\dfrac{12 \times 8 + 4}{24 + 36 \div 6}$ = __________

A. $4\frac{12}{15}$ B. $3\frac{1}{3}$ C. 10 D. $\frac{12}{15}$

18. 3ന്റെ ആദ്യത്തെ 5 ഗുണിതങ്ങളുടെ ശരാശരി

A. 6 B. 9 C. 30 D. 45

19. X-ന്റെ 5 ശതമാനത്തിന്റെ അഞ്ചു ശതമാനം = 3 ആണെങ്കിൽ X = _______

A. 1200 B. 800 C. 75 D. 300

20. താഴെ തന്നിട്ടുള്ളവയിൽ 36×3.6 നു തുല്യമായിട്ടുള്ളത് ഏത് ?

A. $(30 \times 3) + (6 \times 0.06)$ B. $(30 \times 3.6) + (6 \times 8.6)$

C. $(30 + 6) + (3 + 0.06) \times 36$ D. ഇവയൊന്നുമല്ല

21. മണിക്കൂറിൽ 45 കിലോമീറ്റർ വേഗതയിൽ ഓടിക്കൊണ്ടിരിക്കുന്ന ട്രെയിൻ 6 സെക്കന്റിൽ എത്ര ദൂരം സഞ്ചരിക്കും?

A. 72 മീ. B. 60 മീ. C. 75 മീ. D. 70 മീറ്റർ

22. 258 * 4 എന്ന സംഖ്യയെ 9 കൊണ്ട് നിശ്ശേഷം ഹരിക്കണമെങ്കിൽ X ന്റെ സ്ഥാനത്ത് എന്ത് അക്കം വരണം?

A. 1 B. 6 C. 7 D. 8

23. 1521 കുട്ടികളെ തുല്യ വരികളിലും നിരകളിലുമായി നിർത്തണമെങ്കിൽ ആദ്യവരിയിൽ എത്ര കുട്ടികൾ ഉണ്ടായിരിക്കണം?

A. 39 B. 29 C. 41 D. 19

24. 25 ലിറ്റർ ഉള്ള ഒരു മിശ്രിതത്തിൽ വീഞ്ഞും വെള്ളവും 3.2 എന്ന അംശബന്ധത്തിലാണ്. എത്ര വെള്ളം കൂടി ചേർത്താൽ വീഞ്ഞും വെള്ളവും തുല്യ അംശബന്ധത്തിലാകും?

A. 10 ലി. B. 5 ലി. C. 15 ലി. D. 11 ലി.

25. 95500 എന്ന സംഖ്യ ഒരു പൂർണ്ണ വർഗ്ഗം ആകണമെങ്കിൽ ഏറ്റവും കുറഞ്ഞത് ഏത് സംഖ്യ ഇതിൽനിന്ന് കുറയ്ക്കണം?

A. 19 B. 20 C. 1.19 D. 39

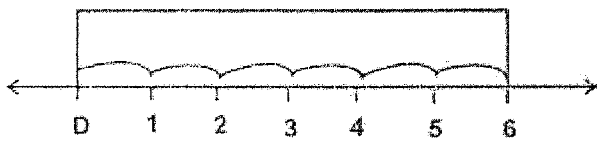
TEST 2 - NUMERICAL (MATHEMATICAL) REASONING

സമയം : 10 മിനിറ്റ്

1. ഒരു ക്ലാസിൽ 'r' വരി ഡസ്കുകളും ഓരോ വരിയിലായി 'd' ഡസ്കുകളും ഉണ്ട്. ക്ലാസിൽ എല്ലാവരും ഹാജരായ ദിവസം '3' ഡസ്കുകൾ ഒഴിഞ്ഞു കിടന്നാൽ ആ ക്ലാസിലെ കുട്ടികളുടെ എണ്ണം.

   A. rd – 3 B. r + d – 3 C. rd D. $\frac{r}{d} - 3$

2. താഴെ തന്നിട്ടുള്ള ചിത്രം നോക്കുക.



   S എന്നതിന്റെ നീളം സൂചിപ്പിക്കുവാൻ ഏറ്റവും നല്ല വിവരണം.

   A. 2 × 3 B. 3 + 2 C. 3 × 2 D. 3 + 3

3. ഒരു വൃത്തത്തിന്റെ ആരം അതിന്റെ പകുതിയായി മാറുമ്പോൾ വിസ്തീർണ്ണം

   A. പകുതിയാകുന്നു B. ഇരട്ടിക്കുന്നു C. നാലിലൊന്നായി മാറുന്നു

   D. വ്യത്യാസം വരുന്നില്ല

4. ഒരു ക്ലാസിൽ 25 മാർക്കിന്റേതായ 5 ടെസ്റ്റുകൾ കൊടുത്തതിൽ ജോണിന് ആദ്യത്തെ 4 ടെസ്റ്റിനും കൂടി കിട്ടിയ ശരാശരി മാർക്ക് 15 എന്നാൽ ഒട്ടാകെ ശരാശരി മാർക്ക് 16 വരണമെങ്കിൽ ജോണിന് 5-ാമത്തെ ടെസ്റ്റിൽ ചുരുങ്ങിയത് എത്ര മാർക്ക് കിട്ടണം?

   A. 15 B. 16 C. 17 D. 20

5. ഒരു തെരഞ്ഞെടുപ്പിൽ 356 വോട്ടർമാരും 5 സ്ഥാനാർത്ഥികളും ഉണ്ട്. ഒരാൾക്ക് ജയിക്കുവാൻ ചുരുങ്ങിയത് എത്ര വോട്ടു കിട്ടണം?

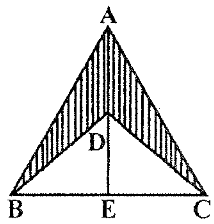
   A. 179 B. 72 C. 178 D. 71

6. x (x – y) = 0 ആയാൽ താഴെ തന്നിട്ടുള്ളതിൽ ഏതു നിഗമനമാണ് ഏറ്റവും ശരിയായിട്ടുള്ളത്?

   A. x = 0 B. x = 0 or x = y C. x = y D. x = 0 and x = y

7. താഴെ തന്ന ചിത്രത്തിൽ BC = 15 സെ.മീ. ലംബം DE ചിത്രത്തിലേതുപോലെ A വരെ 4 സെ.മീ കൂടി നീട്ടിയാൽ, BDCAയുടെ വിസ്തീർണ്ണം.

   A. 30 ചതുരശ്ര സെ.മീ.
   B. 60 ചതുരശ്ര സെ.മീ.
   C. 90 ചതുരശ്ര സെ.മീ.
   D. 120 ചതുരശ്ര സെ.മീ.



8. ഒരു തെരുവിലെ വീടുകൾ 56ൽ തുടങ്ങി 140 വരെയുള്ള ഇരട്ട സംഖ്യകൾകൊണ്ട് മാർക്ക് ചെയ്താൽ ആ തെരുവിൽ എത്ര വീടുകൾ ഉണ്ട് ?

   A. 70 B. 43 C. 42 D. 84

9. സുരേഷ് ക്ലാസിലെ ആൺകുട്ടികളുടെ നിരയിൽ ഇടതു നിന്നായാലും വലതുനിന്നായാലും 15-ാമതായാണ് ഇരിക്കുന്നത് എന്നാൽ ക്ലാസിലെ ആൺകുട്ടികളുടെ എണ്ണം

A. 30 B. 31 C. 29 D. 28

10. ഒരച്ഛൻ മകനോട് പറയുന്നു - "നീ ജനിക്കുമ്പോൾ എനിയ്ക്ക്, നിന്റെ ഇപ്പോഴത്തെ വയസ്സാണ്". അച്ഛന് ഇപ്പോൾ 36 വയസ്സായെങ്കിൽ മകന് 5 വർഷം മുൻപ് വയസ്സെത്ര?

A. 18 B. 13 C. 15 D. 23

11. A, B, C, D, E എന്ന 5 കുട്ടികൾക്ക് 5 പരീക്ഷകളിലായി കിട്ടിയ മാർക്കുകൾ ചുവടെ തരുന്നു.

	I	II	III	IV	V
A	69	71	75	75	79
B	84	79	69	79	80
C	64	67	74	74	79
D	53	54	61	60	62
E	56	58	62	63	68

ഏതു കുട്ടിയുടെ മാർക്കിലാണ് തുടർച്ചയായ വർദ്ധനയുണ്ടായത്?

(A) C (B) D (C) E (D) A

12. സെക്കന്റിൽ 30 മീറ്റർ വേഗതയിൽ സഞ്ചരിക്കുന്ന ഒരു ട്രെയിൻ 600 മീറ്റർ നീളമുള്ള ഒരു പ്ലാറ്റ്ഫോം കടന്നുപോകുവാൻ 30 സെക്കന്റ് എടുത്തു. എന്നാൽ ട്രെയിനിന്റെ നീളം എന്ത്?

(A) 120 മീ. (B) 150 മീ. (C) 900 മീ. (D) 300 മീ.

TEST 3 - ABILITY TO USE SYMBOLS

നിർദ്ദേശങ്ങൾ

ഗണിതശാസ്ത്രത്തിൽ അടിസ്ഥാന ക്രിയകൾക്ക് സാധാരണ ഉപയോഗിക്കുന്ന ചിഹ്നങ്ങൾക്ക് പകരം മറ്റു ചില ചിഹ്നങ്ങൾ ഉപയോഗിച്ചുള്ള ചോദ്യങ്ങളാണ് താഴെ തന്നിട്ടുള്ളത്. ഓരോ ചിഹ്നവും ഇവിടെ എന്തിനെ സൂചിപ്പിക്കുന്നു എന്ന് മനസ്സിലാക്കിയതിനുശേഷം പ്രശ്നങ്ങൾ നിർദ്ധാരണം ചെയ്യുക.

ആവശ്യപ്പെടുമ്പോൾ മാത്രം ചെയ്തു തുടങ്ങുക.

സമയം : 5 മിനിറ്റ്

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1. ⊕ സങ്കലനചിഹ്നത്തേയും + ഗുണനചിഹ്നത്തേയും * ഹരണ ചിഹ്നത്തേയും സൂചിപ്പിക്കുന്നു.

		A	B	C	D
1.	(6 ⊕ 8) + 7 + 2	100	42	28	196
2.	(6 * 3) ⊕ 8	10	25	16	63
3.	12 ⊕ (14 * 7) ⊕ 2 + 4	40	20	22	64
4.	(13 + 5) * 5 ⊕ 25	115	350	95	38
5.	(18 * 6) + (24 * 2) + 12	27	48	168	3

TEST 4 - SPATIAL ABILITY

Instructions: (നിർദ്ദേശങ്ങൾ)

ഈ വിഭാഗത്തിൽ 9 ചോദ്യങ്ങളുണ്ട്. ഓരോന്നിനും 4 വീതം ഉത്തരങ്ങളും ശരിഉത്തരം മനസ്സിലാക്കി പ്രത്യേകം തന്നിട്ടുള്ള ഉത്തരക്കടലാസിൽ നിർദ്ദേശിച്ചിട്ടുള്ള സ്ഥാനത്ത് ' ' എന്ന് അടയാളപ്പെടുത്തുക.

ആവശ്യപ്പെടുമ്പോൾ മാത്രം ചെയ്തു തുടങ്ങുക.

സമയം : 8 മിനിറ്റ്

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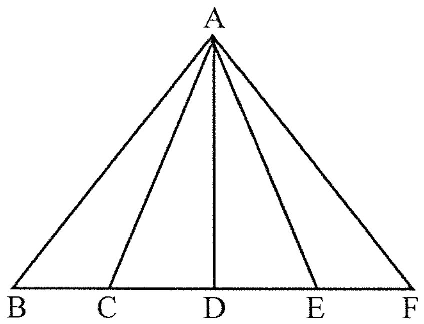
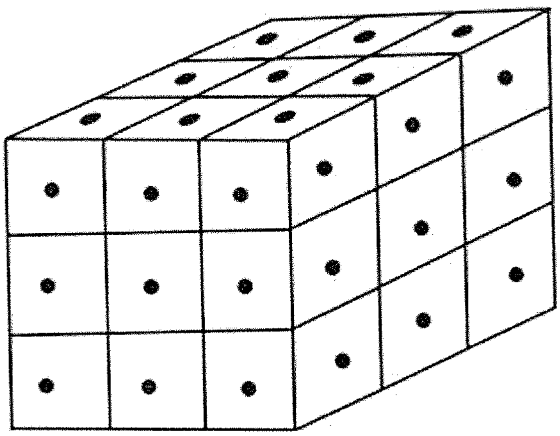
1. താഴെ കൊടുത്തിട്ടുള്ള ചിത്രത്തിൽ ആകെയുള്ള ത്രികോണങ്ങളുടെ എണ്ണം എത്ര?



(A) 10 (B) 8 (C) 12 (D) 9

2. മരംകൊണ്ടുണ്ടാക്കിയ ഒരു ക്യൂബിനെ 27 ചെറിയ തുല്യ ക്യൂബുകളായി വിഭജിച്ചിരിക്കുന്ന വിധം ചിത്രത്തിൽ കാണിച്ചിരിക്കുന്നു. ഓരോ ചെറിയ ക്യൂബിന്റെയും മുഖങ്ങളിൽ ചിത്രങ്ങളിൽ കാണിച്ചിരിക്കുംവിധം ബിന്ദുക്കൾ അടയാളപ്പെടുത്തിയിരിക്കുന്നു.



ചിത്രത്തിൽ നോക്കി താഴെ കൊടുത്തിരിക്കുന്ന ചോദ്യങ്ങൾക്ക് ഉത്തരമെഴുതുക.

2. ഒറ്റ ബിന്ദുവും അടയാളപ്പെടുത്താത്ത ക്യൂബുകളുടെ എണ്ണം എത്ര?

(A) 0 (B) 1 (C) 2 (D) 4

3. ഒരു ബിന്ദു മാത്രം അടയാളപ്പെടുത്തിയ ക്യൂബുകളുടെ എണ്ണം എത്ര?

(A) 4 (B) 6 (C) 8 (D) 10

4. രണ്ടു ബിന്ദുക്കൾ അടയാളപ്പെടുത്തിയ ക്യൂബുകളുടെ എണ്ണം എത്ര?

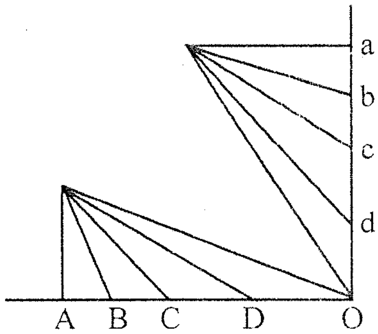
(A) 4 (B) 8 (C) 12 (D) 16

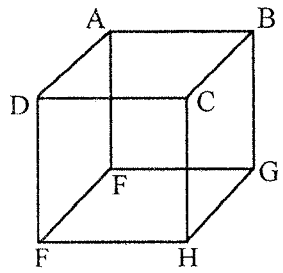
5. മൂന്നു ബിന്ദുക്കൾ അടയാളപ്പെടുത്തിയ ക്യൂബുകളുടെ എണ്ണം എത്ര?

(A) 4 (B) 6 (C) 8 (D) 10

6. ചിത്രത്തിൽ കാണിച്ചിരിക്കുന്ന A B C D E F G H എന്ന ക്യൂബിൽ Aയിൽനിന്നും H ലേക്ക് 8 മൂലകളിലുംകൂടി പോകുന്ന (ഒരു വഴിയിൽ ഒരു മൂലയിൽകൂടി ഒരു പ്രാവശ്യം മാത്രമേ സഞ്ചരിക്കാവൂ) എത്ര വഴികളുണ്ട്?

(A) 8 (B) 6 (C) 4 (D) 2

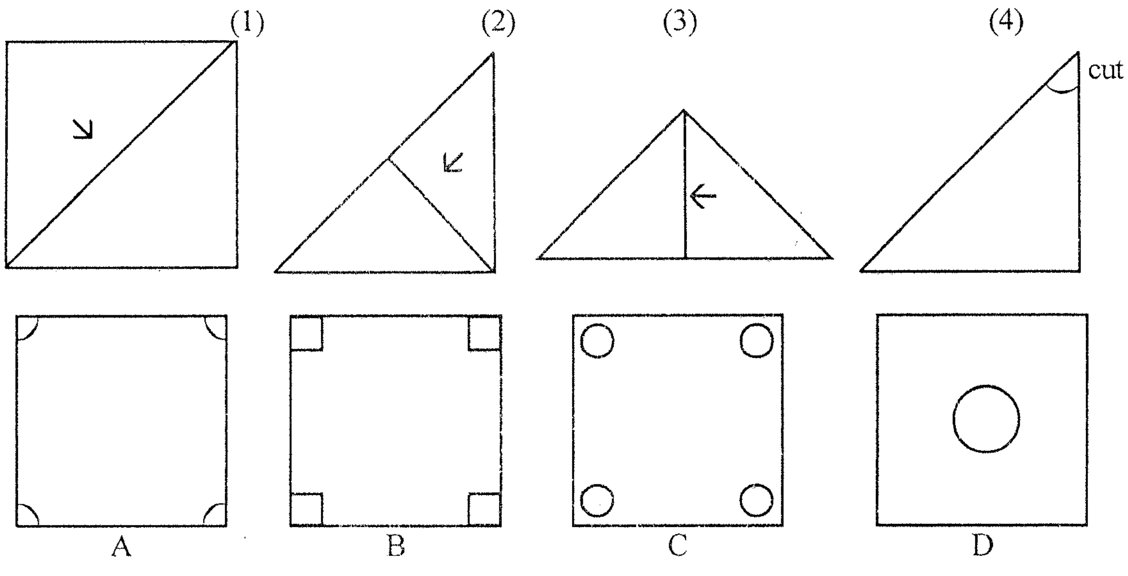




7. മുകളിൽ കൊടുത്തിട്ടുള്ള ചിത്രത്തിൽ Pയിൽനിന്ന് Q വിലേക്ക് ഉള്ള ഏറ്റവും ചെറിയ വഴി യേത്?

(A) POQ (B) PAOQ (C) PAOaQ (D) POaQ

8. ചതുരാകൃതിയിലുള്ള പേപ്പർ ചിത്രത്തിൽ കാണിച്ചിരിക്കുംവിധം തുടരെ മടക്കിയശേഷം 4-ാം ചിത്രത്തിൽ 'cut' എന്നടയാളപ്പെടുത്തിയിടത്ത് കാണിച്ചിരിക്കുംവിധം മുറിക്കുന്നു. അതിനുശേഷം പേപ്പർ മടക്കു നിവർത്തിയാൽ അത് ഉത്തരങ്ങളായി തന്ന ഏത് ചിത്രത്തിന്റെ രീതിയിൽ ആയിരിക്കും?



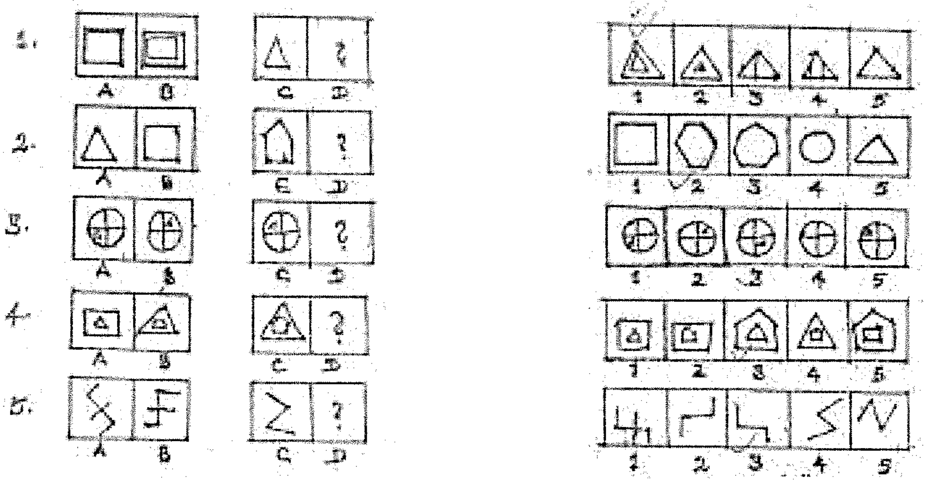
9. ഒരു ക്യൂബ് പെയിന്റ് ചെയ്യേണ്ടതുണ്ട്. രണ്ടു സമീപവശങ്ങളിൽ ഒരേ നിറം ആകാനും പാടില്ല. എന്നാൽ ക്യൂബ് പെയിന്റ് ചെയ്യാൻ ഏറ്റവും കുറഞ്ഞത് എത്ര നിറങ്ങൾ വേണം?

(A) 6 (B) 3 (C) 4 (D) 5

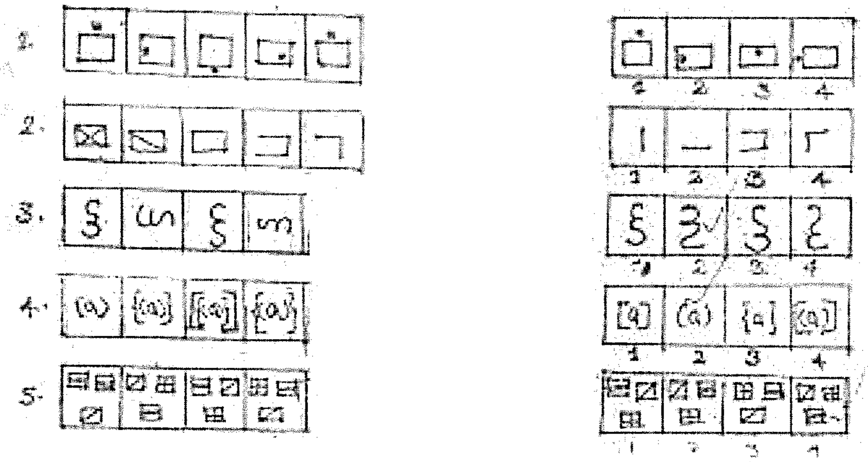
TEST 5 - ABSTRACT REASONING

സമയം : 10 മിനിറ്റ്

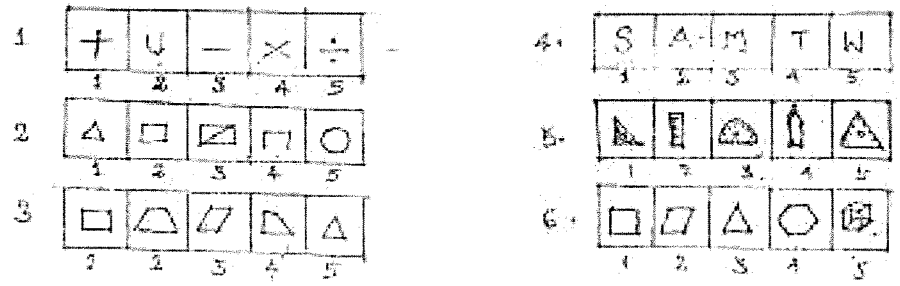
1. താഴെ കൊടുത്തിരിക്കുന്ന ചിത്രങ്ങളിൽ ചിത്രം Aയും ചിത്രം Bയും തമ്മിൽ ഒരു പ്രത്യേക ബന്ധം ഉള്ളതായി കാണാം. ചിത്രം Cയും ചിത്രം Dയുമായി അതേ തരത്തിൽ ബന്ധം വരത്തക്കവിധത്തിൽ തന്നിട്ടുള്ള ചിത്രങ്ങളിൽനിന്ന് ചിത്രം Dയെ തെരഞ്ഞെടുക്കുക.



2. താഴെ കൊടുത്തിരിക്കുന്ന ചിത്രങ്ങൾ ഒരു പ്രത്യേക ക്രമം പിന്തുടരുന്നു. തന്നിട്ടുള്ള ഉത്തരങ്ങളിൽനിന്ന് ഈ ക്രമം പിന്തുടരുന്ന ചിത്രം തെരഞ്ഞെടുക്കുക.



3. താഴെ കൊടുത്തിരിക്കുന്ന ചോദ്യങ്ങളിൽ നാലെണ്ണം ഒരേ തരത്തിലുള്ളതും ഒന്ന് അതിൽപ്പെടാത്തതുമാണ്. വ്യത്യസ്തമായ ചിത്രം കണ്ടുപിടിക്കുക.



Appendix E1

FAROOK TRAINING COLLEGE

Test on Mathematics Content Knowledge at primary level

M.Saheed Ali
Research Scholar

Dr.K.Vijayakumari
Associate Professor
Farook Training College

നിർദ്ദേശങ്ങൾ
1. എല്ലാ ചോദ്യങ്ങളും പരിഗണിക്കുക.
2. ഓരോ ചോദ്യങ്ങൾക്കും നൽകിയിട്ടുള്ള ഉത്തരങ്ങളിൽനിന്നും ശരിയായ ഓപ്ഷനോ, ഉത്തരമോ തെരഞ്ഞെടുത്തെഴുതുക.

1. ഒരു സംഖ്യയുടെ 7% 21 ആണെങ്കിൽ സംഖ്യ ഏത്?
(a) 500 (b) 400 (c) 300 (d) 200

2. ഒരു സംഖ്യയുടെ 5 മടങ്ങും 9 മടങ്ങും തമ്മിലുള്ള വ്യത്യാസം 24 ആണെങ്കിൽ സംഖ്യ?
(a) 4 (b) 5 (c) 6 (d) 7

3. താഴെ കൊടുത്തിരിക്കുന്ന സംഖ്യാശ്രേണിയിലെ അടുത്ത സംഖ്യ ഏത്?
8, 13, 10, 15, 12, 17, 14 ___________
(a) 19 (b) 22 (c) 16 (d) 20

4. ഒരു പാലത്തിന്റെ നിർമ്മാണ പ്രവർത്തി 80 ആളുകൾ 20 ദിവസംകൊണ്ടു പൂർത്തീകരിക്കും. എങ്കിൽ 70 ആളുകളാണെങ്കിൽ പ്രസ്തുത പ്രവർത്തി എത്ര ദിവസംകൊണ്ട് തീരും?
(a) 30 ദിവസം (b) 29 ദിവസം (c) 23 ദിവസം (d) 26 ദിവസം

5. ബാബു ഒരു കാർ 44,000 രൂപയ്ക്ക് വാങ്ങി 48,000 രൂപയ്ക്ക് വിൽക്കുന്നു. എങ്കിൽ ലാഭശതമാനം?
(a) 12% (b) 9.09% (c) 14% (d) 80%

6. ഒരാൾ തന്റെ വരുമാനത്തിന്റെ 15% ആയ 500 രൂപ ഒരു വർഷം നീക്കിവെയ്ക്കുന്നു. എങ്കിൽ അദ്ദേഹത്തിന്റെ വാർഷിക വരുമാനം?
(a) 3542.50 രൂപ (b) 3333.33 രൂപ (c) 3132.30 രൂപ (d) 3075.75 രൂപ

7. ഒരു പ്രൈമറി സ്കൂളിൽ 2012 വർഷത്തിൽ ചേർന്ന കുട്ടികളുടെ എണ്ണം 850 ആണ്. 2013 വർഷത്തിൽ കുട്ടികളുടെ എണ്ണം 1120 ആയാൽ വർദ്ധനവിലുണ്ടായ ശതമാനം എത്ര?
(a) 31.76% (b) 33.50% (c) 30.65% (d) 34.76%

8. ഒരു പരീക്ഷയിൽ 45% കുട്ടികൾ തോൽക്കുകയും 550 കുട്ടികൾ വിജയിക്കുകയും ചെയ്തു. എങ്കിൽ പ്രസ്തുത പരീക്ഷയിൽ പങ്കെടുത്ത ആകെ കുട്ടികളുടെ എണ്ണം.
(a) 1000 (b) 900 (c) 1500 (d) 800

9. റാണിയുടെ വയസ്സിന്റെ $\frac{2}{3}$ ഭാഗത്തോട് 12 കൂട്ടിയാൽ അവളുടെ ഇപ്പോഴത്തെ വയസ്സിനേക്കാൾ 3 വയസ്സ് വർദ്ധിക്കും. എങ്കിൽ അവരുടെ ഇപ്പോഴത്തെ വയസ്സ് എത്ര?
(a) 25 (b) 27 (c) 26 (d) 29

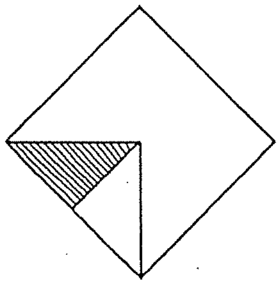
10. $\frac{1}{6}$ ന്റെ എത്ര ഭാഗമാണ് $\frac{1}{12}$?
(a) $\frac{1}{3}$ (b) $\frac{1}{2}$ (c) 2 (d) 3

11. $\frac{1}{2}$ ന്റെ $\frac{1}{4}$ ഭാഗം എത്ര?
(a) 8 (b) $\frac{1}{8}$ (c) $\frac{1}{6}$ (d) $\frac{1}{16}$

PTO

12. $\frac{1}{5} + \frac{1}{3} + \frac{3}{7} - \frac{1}{8} = ?$

(a) $\frac{3}{240}$ (b) $\frac{2}{36}$ (c) $\frac{13}{112}$ (d) ഇവയൊന്നുമല്ല

13. 

ചിത്രത്തിൽ ഷേഡ് ചെയ്ത ഭാഗത്തിന്റെ സംഖ്യ എത്ര?

(a) $\frac{1}{7}$ (b) $\frac{2}{7}$ (c) $\frac{1}{8}$ (d) $\frac{1}{12}$

14. $3\frac{1}{2} - 5\frac{1}{7} + 1\frac{2}{3} = ?$

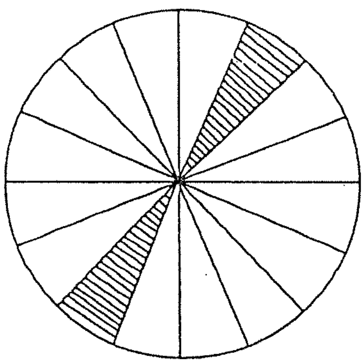
(a) $\frac{13}{42}$ (b) $\frac{18}{42}$ (c) $\frac{27}{42}$ (d) ഇവയൊന്നുമല്ല

15. താഴെ കൊടുത്തിരിക്കുന്നവയിൽ ഏതാണ് വലിയ സംഖ്യ?

(a) 236 ന്റെ $\frac{1}{4}$ ഭാഗം (b) 1028 ന്റെ $\frac{1}{16}$ ഭാഗം

(c) 504 ന്റെ $\frac{1}{9}$ ഭാഗം (d) 741ന്റെ $\frac{1}{3}$ ഭാഗം

16. ഒരാൾ 18 മിനുട്ടുകൊണ്ട് 8 കാറ് കഴുകുന്നുവെങ്കിൽ ഈ നിരക്കിൽ 3 മണിക്കൂർകൊണ്ട് എത്ര കാറ് അദ്ദേഹത്തിന് കഴുകാൻ കഴിയും?
(a) 13 (b) 40 (c) 80 (d) 125

17. 

ചിത്രത്തിലെ ഷേഡ് ചെയ്ത ഭാഗത്തിന്റെ സംഖ്യ എത്ര?

(a) $\frac{1}{4}$ (b) $\frac{1}{6}$ (c) $\frac{1}{8}$ (d) $\frac{1}{12}$

18. ഒരു ബാരലിൽ 10 ബോക്സുണ്ട്. ഓരോ ബോക്സിലും ഒരു ഡസൻ ക്യൂബുകളുണ്ട്. എങ്കിൽ 960 ക്യൂബുകൾ വെയ്ക്കാൻ എത്ര ബാരലുകൾ വേണം?
(a) 7 (b) 8 (c) 9 (d) 12

19. ഒരു സമഭുജത്രികോണത്തിന്റെ ഒരു വശത്തിന്റെ നീളം 7 cm ആയാൽ ചുറ്റളവ്?
(a) 14 cm (b) 21 cm (c) 7 cm (d) 28 cm

20. ചുറ്റളവ് വർദ്ധിക്കുമ്പോൾ പരപ്പളവ് വർദ്ധിക്കുന്നു. ഈ പ്രസ്താവന
(a) തെറ്റ് (b) ശരി (c) എപ്പോഴും ശരിയല്ല
(d) എല്ലായ്പ്പോഴും തെറ്റല്ല

21. 2½ കിലോ പഞ്ചസാരയുടെ വില 120 രൂപയാണെങ്കിൽ 3½ കിലോ പഞ്ചസാരയുടെ വില
(a) 180 രൂപ (b) 200രൂപ (c) 360 രൂപ (d) ഇവയൊന്നുമല്ല

22 താഴെ കൊടുത്ത സംഖ്യകളിൽ 8 കൊണ്ട് നിശ്ശേഷം ഹരിക്കാവുന്നത്
(a) 354102 (b) 620013 (c) 32168 (d) 24182

23. പരപ്പളവ് 26 ചതുരശ്ര സെന്റീമീറ്ററായ ചതുരത്തിൽ 1 സെ.മീ. വശമുള്ള എത്ര സമചതുരങ്ങൾ ഉണ്ടാകും?
(a) 27 (b) 26 (c) 25 (d) 52

24. താഴെ പറയുന്നവയിൽ ദ്വിപദം ഏത് ?
(a) 7 (b) $2x + y$ (c) $2x$ (d) 6ab

25. ഒരു സംഖ്യയുടെ 4 മടങ്ങിനോട് 7 കൂട്ടിയാൽ 19 കിട്ടും. എങ്കിൽ സംഖ്യ?
(a) 26 (b) 28 (c) 30 (d) 3

26. ഒരു ബിന്ദുവിൽ ആരംഭിച്ച് അതേ ബിന്ദുവിൽ അവസാനിക്കുന്ന രൂപങ്ങളെ __________ എന്ന് വിളിക്കുന്നു.

27. എതിർവശങ്ങൾ സമാന്തരമായ ചതുർഭുജമാണ് __________

28. 2 കോണുകളുടെ അളവുകളുടെ തുക 180^0 ആയ കോണുകളെ ________ എന്ന് പറയുന്നു.

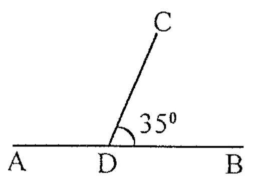
29. സാധാരണ പലിശ കാണുന്നതിനുള്ള ഗണിത സൂത്രവാക്യമാണ് _________

30. 169ന്റെ വർഗ്ഗമൂലം
(a) 11 (b) 12 (c) 13 (d) 14

31. 30, 45, 60 ഈ സംഖ്യകളിലെ പൊതുഘടകം എഴുതുക.

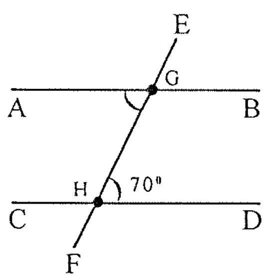
32. $4\frac{3}{5}$ വിഷമഭിന്നമാക്കിയാൽ ലഭിക്കുന്നത്.
(a) $\frac{12}{5}$ (b) $\frac{23}{5}$ (c) $\frac{3}{5}$ (d) $\frac{7}{5}$

33. $\frac{30}{42}$ നെ ലഘുരൂപത്തിലാക്കിയാൽ കിട്ടുന്നത്?
(a) $\frac{11}{3}$ (b) $\frac{7}{5}$ (c) $\frac{5}{7}$ (d) $\frac{13}{4}$

34.


ചിത്രത്തിൽ $\angle BDC = 35^0$ ആണ്.
$\angle ADC$ യുടെ ഡിഗ്രി അളവ് എത്ര?

35. ചിത്രത്തിൽ $\angle GHD = 70^0$ ആയാൽ $\angle AGH$ എത്ര?



36. 2:5 = X : 10 ആയാൽ Xന്റെ വില എത്ര?
(a) 16 (b) 7 (c) 12 (d) 4

37. 40 km / hr വേഗതയിലോടുന്ന ഒരു കാർ 8 മണിക്കൂർ സമയംകൊണ്ട് എത്ര ദൂരം സഞ്ചരിക്കും?
(a) 5 km (b) 300 km (c) 320 km (d) 48 km

38. $\frac{2^7 \times 3^2}{3 \times 2^5}$ ന്റെ വില എത്ര?

(a) 10 (b) 12 (c) 16 (d) 32

39. 2^{38} ന്റെ പകുതി എത്ര?

(a) 2^{39} (b) 2^{35} (c) 2^{37} (b) 2^{19}

40. 3500 രൂപയ്ക്ക് 7% നിരക്കിൽ 5 വർഷത്തെ സാധാരണ പലിശ എത്ര?

(a) 1200 (b) 1225 (c) 2400 (d) 7000

41. ഒരു തുക 16% സാധാരണ പലിശനിരക്കിൽ 5 വർഷത്തേയ്ക്ക് ഒരു കമ്പനിയിൽ നിക്ഷേപിച്ചപ്പോൾ 4000 രൂപ പലിശയിനത്തിൽ ലഭിച്ചുവെങ്കിൽ നിക്ഷേപിച്ച തുകയെത്ര ?

(a) 4000 (b) 5000 (c) 6000 (d) 4500

42. ഒരു സമചതുരത്തിന്റെ പരപ്പളവ് 144cm^2 ആയാൽ അതിന്റെ ചുറ്റളവ് എത്ര?

(a) 72 cm (b) 36 cm (c) 15 cm (d) 48 cm

43. ഒരു സമചതുരത്തിന്റെ ഒരു വശം ഇരട്ടിയാകുമ്പോൾ പരപ്പളവ് എത്ര ഇരട്ടിയാകും?

(a) 4 (b) 2 (c) 6 (d) 8

44. ഒരു സമചതുരത്തിന്റെ ഒരു വശം 12 cm ആയാൽ അതിന്റെ വികർണ്ണത്തിന്റെ നീളം?

(a) 48 cm (b) 144 cm (c) 16.97 cm (d) 36 cm

45. 12 മീറ്റർ നീളവും 10 മീറ്റർ വീതിയുമുള്ള ഒരു പൂന്തോട്ടത്തിനു ചുറ്റും വെളിയിലായി 2 മീറ്റർ വീതിയുള്ള ഒരു നടപ്പാത നിർമ്മിച്ചാൽ അതിന്റെ പരപ്പളവ്?

(a) 104 ച.മീ. (b) 108 ച.മീ. (c) 102 ച.മീ. (d) 110 ച.മീ.

46. 112 മീറ്റർ നീളവും 78 മീറ്റർ വീതിയുള്ള ഒരു പൂന്തോട്ടത്തിനു ചുറ്റും അകത്തായി 2.5 മീറ്റർ വീതിയിൽ ഒരു പാത നിർമ്മിച്ചാൽ പാതയുടെ വിസ്തീർണ്ണം.

(a) 950 ച.മീ. (b) 1050 ച.മീ. (c) 925 ച.മീ. (d) 875 ച.മീ.

47. $\frac{27}{100}$ നു തുല്യമായ ദശാംശഭിന്നം ഏത്?

(a) 0.27 (b) 0.027 (c) 2.7 (d) 2700

48. 0.7 നോട് എത്ര കൂട്ടിയാൽ 1 കിട്ടും?

(a) 0.7 (b) 1 (c) 0.3 (d) 1.3

49. 0.4 നെ എത്രകൊണ്ട് ഗുണിച്ചാൽ 1 കിട്ടും?

(a) 0 (b) 2.3 (c) 2.5 (d) 0.5

50 $\frac{1}{2} + \frac{1}{3} \times \frac{1}{4}$ ന്റെ വില എത്ര?

(a) $\frac{3}{12}$ (b) $\frac{7}{12}$ (c) $\frac{4}{12}$ (d) $\frac{5}{12}$

51. $3\frac{1}{2} + 6\frac{1}{4} + 7\frac{3}{4}$ ന്റെ വില എത്ര?

(a) $16\frac{1}{2}$ (b) $25\frac{1}{4}$ (c) $17\frac{1}{2}$ (d) $17\frac{3}{4}$

52. $\frac{3}{8}$ ന്റെ ഒരു സമാനഭിന്നമായി എഴുതാവുന്നത്

(a) $\frac{6}{24}$ (b) $\frac{9}{64}$ (c) $\frac{6}{16}$ (d) $\frac{5}{13}$

53. $\frac{6}{5}$ ന്റെ ഒരു സമാനഭിന്നരൂപം

(a) $\frac{36}{30}$ (b) $\frac{24}{21}$ (c) $\frac{11}{30}$ (d) $\frac{30}{35}$

54. ഒരു വിഷമഭിന്നത്തിന്റെ വില

(a) ഒന്നിനേക്കാൾ കുറവ് ആയിരിക്കും

(b) ഒന്നിനേക്കാൾ കൂടുതൽ ആയിരിക്കും

(c) ഒന്നിനോട് തുല്യം ആയിരിക്കും

(d) മുകളിൽ പറഞ്ഞതെല്ലാം ശരിയാണ്

55. അംശവും ഛേദവും തുല്യമായ ഒരു ഭിന്നസംഖ്യയുടെ വില

(a) 0 (b) 1 (c) 1 നേക്കാൾ കുറവ് (d) ഒന്നിനേക്കാൾ കൂടുതൽ

56. ഒരു വൃത്തത്തിന്റെ വ്യാസം 10 cm ആയാൽ അതിന്റെ ചുറ്റളവ്

(a) 10π cm (b) 8π cm (c) 16π cm (d) 32π cm

57. ഒരു വൃത്തത്തിന്റെ ചുറ്റളവ് 94.2 മീറ്റർ ആയാൽ അതിന്റെ ആരം എത്ര?

(a) 30 മീറ്റർ (b) 15 മീറ്റർ (c) 7.5 മീറ്റർ (d) 32 മീറ്റർ

58. ഒരു വൃത്തത്തിന്റെ പരപ്പളവ് $64\pi m^2$ ആയാൽ അതിന്റെ വ്യാസം?

(a) 8 മീറ്റർ (b) 4 മീറ്റർ (c) 16 മീറ്റർ (d) 32 മീറ്റർ

59. ഒരു മട്ടത്രികോണത്തിന്റെ കർണ്ണത്തിന്റെ നീളം 5 cm പാദത്തിന്റെ നീളം 3 cm എങ്കിൽ ലംബത്തിന്റെ നീളം എത്ര?

(a) 8 cm (b) 5 cm (c) 4 cm (d) 2 cm

60. 5 വശമുള്ള ഒരു ബഹുഭുജത്തിന് എത്ര വികർണ്ണങ്ങളുണ്ട്?

(a) 3 (b) 4 (c) 5 (d) 6

61. $7 \times (12 + 9) \div 3 - 9$ ക്രിയ ചെയ്താൽ ലഭിക്കുന്നത്?

(a) 20 (b) 30 (c) 40 (d) 50

62. കൂട്ടത്തിൽ ബന്ധമില്ലാത്ത സംഖ്യ തെരഞ്ഞെടുക്കുക.

(a) $\sqrt{25}$ (b) $\sqrt{625}$ (c) $\sqrt{425}$ (d) $\sqrt{225}$

63. ഒരു സ്കൂളിൽ 53% പെൺകുട്ടികളാണ്. ആൺകുട്ടികളേക്കാൾ 180 പെൺകുട്ടികൾ കൂടുതലുണ്ടെങ്കിൽ ആൺകുട്ടികളുടെ എണ്ണം എത്ര ?

(a) 1590 (b) 2000 (c) 1410 (d) 1820

64. പൂരിപ്പിക്കുക 1, 5, 13, 25, 41, ...

(a) 64 (b) 61 (c) 71 (d) 81

65. ഒറ്റയാനെ കണ്ടുപിടിക്കുക.

(a) 121 (b) 81 (c) 64 (d) 84

66. ഒരു ക്ലാസ്സിൽ ആൺകുട്ടികളും പെൺകുട്ടികളും തമ്മിലുള്ള അംശബന്ധം 5:4 ആണ്. ആ ക്ലാസിൽ 20 പെൺകുട്ടികൾ ഉണ്ടെങ്കിൽ ആൺകുട്ടികളുടെ എണ്ണം?

(a) 20 (b) 25 (c) 15 (d) 30

67. സംഖ്യാരേഖയിൽ -5 മുതൽ 6 വരെയുള്ള അകലം എത്ര?

(a) 1 (b) 5 (c) 6 (d) 11

68. ഒറ്റയാനെ തെരഞ്ഞെടുക്കുക.

(a) വൃത്തം (b) സ്തൂപിക (c) ക്യൂബ് (d) സിലിണ്ടർ

69. $(a^3)^2$ ന്റെ വില?

(a) a^5 (b) a^6 (c) a^9 (d) ഇതൊന്നുമല്ല

70. $\frac{1}{5} + \frac{1}{4} - \frac{1}{2}$ ന്റെ ഫലം?

(a) $\frac{1}{20}$ (b) $\frac{-1}{20}$ (c) $\frac{1}{7}$ (d) $\frac{1}{40}$

71. താഴെ കൊടുത്ത സംഖ്യകളിൽ ഏറ്റവും വലുത് ഏത്?

(a) 0.05 (b) 0.0505 (c) 0.505 (d) 0.5

72. 1, 2, 3, 4 ഇവ ഉപയോഗിച്ചുണ്ടാക്കാവുന്ന ഏറ്റവും വലിയ സംഖ്യ?

(a) 1234 (b) 4123 (c) 4321 (d) 4312

73. $\frac{-2}{3}$ ന്റെ ഗുണന വിപരീതം

(a) $\frac{-3}{2}$ (b) $\frac{3}{2}$ (c) $\frac{2}{3}$ (d) $\frac{-2}{3}$

74. ഏറ്റവും ചെറിയ നാലക്കസംഖ്യയുടെയും ഏറ്റവും വലിയ മൂന്നക്കസംഖ്യയുടെയും തുകയെന്ത്?

(a) 1100 (b) 1999 (c) 9991 (d) 1001

75. അടുത്ത സംഖ്യ എഴുതുക.

1, 1, 2, 4, 7 ______

(a) 8 (b) 11 (c) 10 (d) 9

76. അടുത്ത സംഖ്യ ഏത്?

125, 64, 27, 8, ______

(a) 2 (b) 3 (c) 0 (d) 1

77. 1നും 10നും ഇടയ്ക്ക് എത്ര അഭാജ്യസംഖ്യകളുണ്ട്?

(a) 3 (b) 4 (c) 5 (d) 6

78. $(2x)^3$ ന് തുല്യമായത്?

(a) $2x^3$ (b) $6x^3$ (c) $8x^2$ (d) $8x^3$

79. $\dfrac{300 \div 25}{600 \div 50}$ ന്റെ ഉത്തരം?

(a) 10 (b) 5 (c) 1 (d) 2

80. കൂട്ടത്തിൽ ചേരാത്തത് ഏത്?

(a) 169 (b) 179 (c) 136 (d) 149

81. $\dfrac{25 \times 25 - 15 \times 15}{25 + 15}$ = ________

(a) 8 (b) 10 (c) 12 (d) 14

82. ഒരു സമചതുരത്തിന്റെ വശം 4 മടങ്ങാകുമ്പോൾ വിസ്തീർണ്ണം എത്ര മടങ്ങാകും?

(a) 8 (b) 16 (c) 32 (d) 64

83. ഒരു സമചതുരത്തിന്റെ വശം ഇരട്ടിയാകുമ്പോൾ ചുറ്റളവ് എത്ര ഇരട്ടിയാകും?

(a) 2 (b) 4 (c) 8 (d) 6

84. x : y എന്നീ സംഖ്യകൾ 4 : 9 എന്ന അംശബന്ധത്തിലാണ് എന്നാൽ x ന്റെ എത്ര ഭാഗമാണ് y ?

(a) $\frac{4}{9}$ (b) $\frac{9}{4}$ (c) $\frac{4}{13}$ (d) $\frac{9}{13}$

85. ഒരു ചതുരത്തിന്റെ നീളം 18 cm, വീതി 10 cm ആയാൽ അതിന്റെ ചുറ്റളവ് എത്ര?

(a) 48 cm (b) 50 cm (c) 56 cm (d) 52 cm

86. സമഭുജത്രികോണത്തിന്റെ ഒരു വശം 'a' ആയാൽ പരപ്പളവ് എത്ര?

(a) a^2 (b) $\frac{\sqrt{3}}{4}a^2$ (c) $2(a + b)$ (d) $4a^2$

87. ഒരു വൃത്തത്തിന്റെ ആരം 'r' ആയാൽ ചുറ്റളവ് ?

(a) πr^2 (b) $2\pi r$ (c) πr (d) $2\pi r^2$

88. ഒരു സമചതുരത്തിന്റെ വശങ്ങൾ ഇരട്ടിയാകുമ്പോൾ ചുറ്റളവ് എത്ര ഇരട്ടിയാകും?

(a) 2 (b) 4 (c) 6 (d) 8

89. 6 cm നീളമുള്ള ഒരു സമചതുരത്തിന്റെ പരപ്പളവ് എത്ര?

(a) $18cm^2$ (b) $36cm^2$ (c) 36 cm (d) $24cm^2$

90. 0, 2, 3, 7, 8 എന്നീ സംഖ്യകളുടെ ശരാശരി എത്ര?

(a) 5 (b) 4 (c) 6 (d) 10

91. 10, 20, 30, 40, 50 എന്നീ സംഖ്യകളുടെ ശരാശരി എത്ര?

(a) 20 (b) 50 (c) 30 (d) 50

92. $(a^0)^2$ ന്റെ വില

(a) 1 (b) 2 (c) a (d) 0

93. $\sqrt{a} \times \sqrt{a}$ എത്ര?

(a) a (b) a^2 (c) $2\sqrt{a}$ (d) 1

94. $\sqrt{12} \times \sqrt{50}$ ന്റെ വില?

(a) $10\sqrt{6}$ (b) $5\sqrt{3}$ (c) $10\sqrt{3}$ (d) $5\sqrt{6}$

95. $\frac{3}{5}$, $\frac{19}{12}$, $\frac{6}{5}$, $\frac{1}{14}$ എന്നീ ഭിന്നസംഖ്യകളിൽ മൂല്യം കുറഞ്ഞതേത്?

(a) $\frac{19}{15}$ (b) $\frac{3}{5}$ (c) $\frac{6}{5}$ (d) $\frac{1}{14}$

96. ഏറ്റവും വലിയ രണ്ടക്ക അഭാജ്യ സംഖ്യ ഏത്?

(a) 97 (b) 95 (c) 99 (d) 98

97. $x - 1$ ന്റെ സങ്കലന വിപരീതം

(a) $x + 1$ (b) $-x - 1$ (c) $-x + 1$ (d) $-x - (+1)$

98. 0.001×0.20 ന്റെ വില

(a) 0.02 (b) 0.0002 (c) 0.002 (d) 0.2

99. 40 cm ചുറ്റളവുള്ള 4 സമചതുരങ്ങൾ ഒരു വരിയിൽ ചേർത്തുവെയ്ക്കുന്നു. ഇപ്പോൾ കിട്ടിയ ചതുരത്തിന്റെ ചുറ്റളവ് എത്ര ?

(a) 160 cm (b) 100 cm (c) 44 cm (d) 50 cm

100. ഒരു സമചതുരത്തിന്റെ ഒരു വികർണ്ണത്തിന്റെ നീളം 12 cm ആയാൽ സമചതുരത്തിന്റെ പരപ്പളവ്?

(a) $144\ cm^2$ (b) $36\ cm^2$ (c) $48\ cm^2$ (d) $72\ cm^2$

Farook Training College - Calicut

Test on Mathematics Content Knowledge at Primary Level

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Instructions

1. Answer all questions
2. Choose the correct answer or option of the questions given

1. 7% of a number is 21, then which is the number?
(a) 500 (b) 400 (c) 300 (d) 200

2. The difference between 5 times of a number and 7 times of that number is24,then number is
(a) 4 (b) 5 (c) 6 (d) 7

3. Write the next number in the series
8, 13, 10, 15, 12, 17, 14 ___________
(a) 19 (b) 22 (c) 16 (d) 20

4. The cunstruction work of a bridge will be completed by 80 persons within 20 days.Then number of days taken when persons are 70?
(a) 30 days (b) 29 days (c) 23 days (d) 26 days

5. Babu purchased a car for a price Rs.44000 and sold it for Rs.48000. Then what is the percentage of profit?
(a) 12% (b) 9.09% (c) 14% (d) 80%

6. A person saves Rs,500 which is 15% of his income.Then his annual income?
(a) 3542.50 (b) 3333.33 (c) 3132.30 (d) 3075.75

7. In 2012 academic year ,the number of admission in aprimary school is 850.In 2013, the admission is 1120,then percentage of increase
(a) 31.76% (b) 33.50% (c) 30.65% (d) 34.76%

8. 45% of students were failed and 550 students were passed in an exam,then the number of participants in the examination is:
(a) 1000 (b) 900 (c) 1500 (d) 800

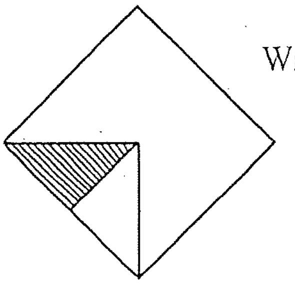
9. The addition of $\frac{2}{3}$ part to 12 will get the increase of 3 with the present age of Rani,then what is her present age?
(a) 25 (b) 27 (c) 26 (d) 29

10. How much is $\frac{1}{6}$ of $\frac{1}{12}$?
(a) $\frac{1}{3}$ (b) $\frac{1}{2}$ (c) 2 (d) 3

11. $\frac{1}{2}$ of $\frac{1}{4}$?
(a) 8 (b) $\frac{1}{8}$ (c) $\frac{1}{6}$ (d) $\frac{1}{16}$

12. $\frac{1}{5} + \frac{1}{3} + \frac{3}{7} - \frac{1}{8} = ?$

(a) $\frac{3}{240}$ (b) $\frac{2}{36}$ (c) $\frac{13}{112}$ (d) None of these

13.  Write the number of shaded portion?

(a) $\frac{1}{7}$ (b) $\frac{2}{7}$ (c) $\frac{1}{8}$ (d) $\frac{1}{12}$

14. $3\frac{1}{2} - 5\frac{1}{7} + 1\frac{2}{3} = ?$

(a) $\frac{13}{42}$ (b) $\frac{18}{42}$ (c) $\frac{27}{42}$ (d) None of these

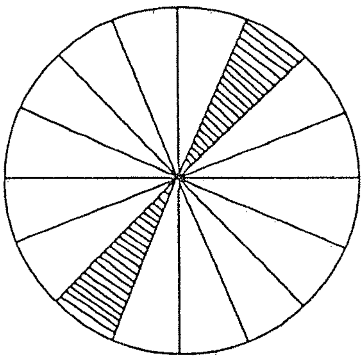
15. Which of the following is the biggest number?

(a) $\frac{1}{4}^{th}$ part of 236 (b) $\frac{1}{16}^{th}$ part of 1028

(c) $\frac{1}{9}^{th}$ part of 504 (d) $\frac{1}{3}^{th}$ part of 741

16. A person washes 8 cars within 18 minutes. Then how many cars can he wash within 3 hours?

(a) 13 (b) 40 (c) 80 (d) 125

17.  Write the number of shaded partion in the picture

(a) $\frac{1}{4}$ (b) $\frac{1}{6}$ (c) $\frac{1}{8}$ (d) $\frac{1}{12}$

18 10 boxes are in a barrel.and 1 dozen cubes are in each barrel. Then, how many barrels are needed to fill 960 cubes?

(a) 7 (b) 8 (c) 9 (d) 12

19 The perimeter of an equilateral triangle with a side 7cm

(a) 14 cm (b) 21 cm (c) 7 cm (d) 28 cm

20 Area increases while perimeter increases,this statement is always

(a) false (b) true (c) not always true

(d) not always false

21 Price of 2½ kg sugar is 120 then price of 3½ kg sugar is?

(a) 180 (b) 200 (c) 360 (d) none of these

22 Which of the folllowing is divisible by 8

(a) 354102 (b) 620013 (c) 32168 (d) 24182

23. How many squares with 1 cm sideare in a rectangle with 26 cm^2

(a) 27 (b) 26 (c) 25 (d) 52

24. Write the binomial from the following

(a) 7 (b) $2x + y$ (c) $2x$ (d) 6ab

25 When 7 added to 4times of a number will get 19. Then the number is

(a) 26 (b) 28 (c) 30 (d) 3

26. The name of the shape with starting from one point and end with the same point is..............

27.The quadrilateral with opposite sides are parallel is____________

28. The sum of two angles is 180 is named as _________

29. The formula for finding the simple interest is __________

30. The square root of 169

(a) 11 (b) 12 (c) 13 (d) 14

31. write the HCF of the numbers 30, 45, 60

(a) 45 (b) 60 (c) 5 (d) 6

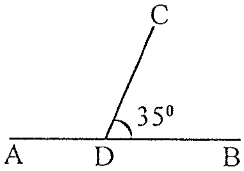
32. $4\frac{3}{5}$ is converted into difficult fraction

(a) $\frac{12}{5}$ (b) $\frac{23}{5}$ (c) $\frac{3}{5}$ (d) $\frac{7}{5}$

33. $\frac{30}{42}$ is changed into simple form will get?

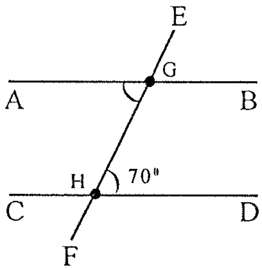
(a) $\frac{11}{3}$ (b) $\frac{7}{5}$ (c) $\frac{5}{7}$ (d) $\frac{13}{4}$

34.



In the figure $\angle BDC = 35^0$ then $\angle ADC$ is?

35. In the figure $\angle$ GHD = 70^0 then $\angle$ AGH is?



36. 2:5 = X : 10 ,then value of X?

(a) 16 (b) 7 (c) 12 (d) 4

37. A car with 40 km / hr speed can travel howmany kilo metre within 8 hours?

(a) 5 km (b) 300 km (c) 320 km (d) 48 km

38. The value of $\frac{2^7 \times 3^2}{3 \times 2^5}$

(a) 10 (b) 12 (c) 16 (d) 32

39. The half of 2^{38} is?

(a) 2^{39} (b) 2^{35} (b) 2^{37} (b) 2^{19}

40. What is the simple interest of 3500 with 7% rate for 5 years ?

(a) 1200 (b) 1225 (c) 2400 (d) 7000

41. An amount deposited in a compny with 16% simple interest for 5 years, got 4000 as interest, then the deposited amount is?

(a) 4000 (b) 5000 (c) 6000 (d) 4500

42. Write the perimeter of a square with area $144 cm^2$?

(a) 72 cm (b) 36 cm (c) 15 cm (d) 48 cm

43. When a side of a square is doubled, then how much its area is doubled ?

(a) 4 (b) 2 (c) 6 (d) 8

44. Length of the diagonal of a square with a side 12 cm is ?

(a) 48 cm (b) 144 cm (c) 16.97 cm (d) 36 cm

45. A garden with 12 meter length and 10 meter breadth has to be constructed a path with 2 meter breadth, then area of the pathway is?

(a) $104 cm^2$ (b) $108 cm^2$ (c) $102 cm^2$ (d) $110 cm^2$

46. A garden with 112 meter length and 78 meter breadth and has a path way with 2.5 meter breadth, then the area of the pathway is ?

(a) $950 cm^2$ (b) $1050 cm^2$ (c) $925 cm^2$ (d) $875 cm^2$

47. $\frac{27}{100}$ is suitable to which decimal number?

(a) 0.27 (b) 0.027 (c) 2.7 (d) 2700

48. To get the number 1, which number is to be added to 0.7 ?

(a) 0.7 (b) 1 (c) 0.3 (d) 1.3

49. Which of the following number multiplied with 0.4 will get 1 is ?

(a) 0 (b) 2.3 (c) 2.5 (d) 0.5

50. The value of $\frac{1}{2} + \frac{1}{3} \times \frac{1}{4}$?

(a) $\frac{3}{12}$ (b) $\frac{7}{12}$ (c) $\frac{4}{12}$ (d) $\frac{5}{12}$

51. The value of $3\frac{1}{2} + 6\frac{1}{4} + 7\frac{3}{4}$?

(a) $16\frac{1}{2}$ (b) $25\frac{1}{4}$ (c) $17\frac{1}{2}$ (d) $17\frac{3}{4}$

52. $\frac{3}{8}$ is equivalent to

(a) $\frac{6}{24}$ (b) $\frac{9}{64}$ (c) $\frac{6}{16}$ (d) $\frac{5}{13}$

53. $\frac{6}{5}$ is equal to which fraction?

(a) $\frac{36}{30}$ (b) $\frac{24}{21}$ (c) $\frac{11}{30}$ (d) $\frac{30}{35}$

54. The vaue of a difficlut fraction

(a) less than 1
(b) greater than 1
(c) equal to 1
(d) All of the above

55. The value of a fraction with the dinominator and numerator are same is:

(a) 0 (b) 1 (c) less than1 (d) greater than 1

56. The perimter of the circle with diamter 10cm

(a) 10π cm (b) 8π cm (c) 16π cm (d) 32π cm

57. The perimeter of a circle is 94.2m,then its radius is?

(a) 30 m (b) 15 m (c) 7.5 m (d) 32 m

58. The area of a circle is $64\pi cm^2$,then its radius?

(a) 8 m (b) 4 m (c) 16 m (d) 32 m

59 The length of altitude when the length of hypotenuse 5 cm and the length of the base with 3 cm is:

(a) 8 cm (b) 5 cm (c) 4 cm (d) 2 cm

60. Number of diagonals of a polygon with 5 sides

(a) 3 (b) 4 (c) 5 (d) 6

61. Value of $7 \times (12 + 9) \div 3 - 9$?

(a) 20 (b) 30 (c) 40 (d) 50

62. write the number which is not connected with the group.

(a) $\sqrt{25}$ (b) $\sqrt{625}$ (c) $\sqrt{425}$ (d) $\sqrt{225}$

63. 53% of students in a school are girls. The number of girls is 180 more than that of boys, then the number of boys is ?

(a) 1590 (b) 2000 (c) 1410 (d) 1820

64 . fill the blanks 1, 5, 13, 25, 41, ...

(a) 64 (b) 61 (c) 71 (d) 81

65. Choose the odd one out

(a) 121 (b) 81 (c) 64 (d) 84

66. The ratio of the boys and girls is 5:3. The number of gilrs are 20, then the number of boys are:

(a) 20 (b) 25 (c) 15 (d) 30

67. The distance from -5 to 6 in a number line is ?

(a) 1 (b) 5 (c) 6 (d) 11

68. Choose the Odd one out.

(a) circle (b) cone (c) cube (d) cylinder

69. The value of $(a^3)^2$

(a) a^5 (b) a^6 (c) a^9 (d) None of these

70. The value of $\frac{1}{5} + \frac{1}{4} - \frac{1}{2}$?

(a) $\frac{1}{20}$ (b) $\frac{-1}{20}$ (c) $\frac{1}{7}$ (d) $\frac{1}{40}$

71. Which of the following is the biggest number ?

(a) 0.05 (b) 0.0505 (c) 0.505 (d) 0.5

72. Write the biggest number using the digits 1, 2, 3, 4 ?

(a) 1234 (b) 4123 (c) 4321 (d) 4312

73. The reciprocal of $\frac{-2}{3}$

(a) $\frac{-3}{2}$ (b) $\frac{3}{2}$ (c) $\frac{2}{3}$ (d) $\frac{-2}{3}$

74. The sum of the smallest 4 digit number and biggest 3 digit number is:

(a) 1100 (b) 1999 (c) 9991 (d) 1001

75. Write the next number

1, 1, 2, 4, 7 _____

(a) 8 (b) 11 (c) 10 (d) 9

76. Which is the next number?

125, 64, 27, 8, ______

(a) 2 (b) 3 (c) 0 (d) 1

77. How many prime numbers are there in between 1 and 10

(a) 3 (b) 4 (c) 5 (d) 6

78. The value of $(2x)^3$ is equivalent to

(a) $2x^3$ (b) $6x^3$ (c) $8x^2$ (d) $8x^3$

79. $\dfrac{300 \div 25}{600 \div 50}$?

(a) 10 (b) 5 (c) 1 (d) 2

80. Write the odd one out?

(a) 169 (b) 179 (c) 136 (d) 149

81. $\dfrac{25 \times 25 - 15 \times 15}{25 + 15} =$ ________

(a) 8 (b) 10 (c) 12 (d) 14

82. How many times the area of a square is increased when its side is 4 times increased ?

(a) 8 (b) 16 (c) 32 (d) 64

83. How much the perimeter doubles when its side of a square is double?

(a) 2 (b) 4 (c) 8 (d) 6

84. x : y is given in the ratio 4 : 9 then howmany part of x is y?

(a) $\frac{4}{9}$ (b) $\frac{9}{4}$ (c) $\frac{4}{13}$ (d) $\frac{9}{13}$

85. What is the perimeter of a rectangle if its length is 18cm and breadth 10 cm?

(a) 48 cm (b) 50 cm (c) 56 cm (d) 52 cm

86. The area of a equilaterla triangle with side a ?

(a) a^2 (b) $\frac{\sqrt{3}}{4}a^2$ (c) $2(a+b)$ (d) $4a^2$

87. Perimeter of a cirlce with radius r?

(a) πr^2 (b) $2\pi r$ (c) πr (d) $2\pi r^2$

88. How much perimeter of a sqaure increases when its sides are doubled?

(a) 2 (b) 4 (c) 6 (d) 8

89. The area of a square with side 6 cm?

(a) $18cm^2$ (b) $36cm^2$ (c) 36 cm (d) $24cm^2$

90. The average of the numbers 0, 2, 3, 7, 8 ?

(a) 5 (b) 4 (c) 6 (d) 10

91. 10, 20, 30, 40, 50 , the average of these numbers?

(a) 20 (b) 50 (c) 30 (d) 50

92. The value of $(a^0)^2$

(a) 1 (b) 2 (c) a (d) 0

93. $\sqrt{a} \times \sqrt{a} = ?$

(a) a (b) a^2 (c) $2\sqrt{a}$ (d)1

94. $\sqrt{12} \times \sqrt{50}$?

(a) $10\sqrt{6}$ (b) $5\sqrt{3}$ (c) $10\sqrt{3}$ (d) $5\sqrt{6}$

95. $\frac{3}{5}$, $\frac{19}{12}$, $\frac{6}{5}$, $\frac{1}{14}$ write the fraction with lowest value?

(a) $\frac{19}{15}$ (b) $\frac{3}{5}$ (c) $\frac{6}{5}$ (d) $\frac{1}{14}$

96. Choose the biggest two digit prime number?

(a) 97 (b) 95 (c) 99 (d) 98

97. The additive inverse of x-1 is:

(a) x + 1 (b) -x - 1 (c) -x + 1 (d) -x - (+1)

98. 0.001 x 0.20 is

(a) 0.02 (b) 0.0002 (c) 0.002 (d) 0.2

99. 4 squares are arranged with 40 cm perimeter then the total perimeter of the rectangle is

(a) 160 cm (b) 100 cm (c) 44 cm (d) 50 cm

100. The area of the square with length of the diagonal is 12 cm

(a) 144 cm^2 (b) 36 cm^2 (c) 48 cm^2 (d) 72 cm^2

APPENDIX E3

SCORING KEY-Test on Mathematics Content Knowledge at primary level

1.C
2.C
3.A
4.A
5.B
6.B
7.C
8.D
9.A
10.B
11.B
12.D
13.C
14.D
15.D
16.C
17.C
18.B
19.B
20.B
21.D
22.C
23.B
24.B
25.D
26.CLOSED FIGURE
27.Parallelogram
28.suppliementray angles
29.I=PNR
30.C
31.C
32.B
33.C
34.145^0
35.70^0
36.D
37.C
38.B
39.C
40.B
41.B
42.D
43.A
44.C
45.A
46.A
47.A
48.C
49.C
50.B
51.C
52.C
53.A
54.B
55.B
56.A
57.B
58.C
59.C
60.C
61.C
62.C
63.B
64.B
65.D
66.B
67.D
68.A
69.B
70.B
71.C
72.C
73.A
74.B
75.B
76.D
77.B
78.D
79.C
80.A
81.B
82.B
83.B
84.C
85.C
86.B
87.B
88.A
89.B
90.B
91.C
92.A
93.A
94.A
95.D
96.A
97.C
98.B
99.B
100.D

Appendix-F1

പ്രീ-സർവീസ്
വിദ്യാർത്ഥികൾക്കുവേണ്ടിയുള്ള

സ്വയം പഠന സാമഗ്രി

ഗണിതം മൊഡ്യൂൾ

പ്രൈമറിതലം

ഗവേഷണ പഠനത്തിനായി തയ്യാറാക്കിയത്

മൊഡ്യൂളുകൾ

ഒരു പ്രത്യേക ഉള്ളടക്കവുമായി ബന്ധപ്പെട്ട് നിർദ്ദിഷ്ട ലക്ഷ്യങ്ങൾ നേടുന്നതിന് ഒരു പഠിതാവിനെ സഹായിക്കുന്ന സ്വയം പഠന സാമഗ്രികളാണ് മൊഡ്യൂളുകൾ. ഇതിൽ ഉള്ളടക്കവുമായി ബന്ധപ്പെട്ട ആമുഖം, ലക്ഷ്യങ്ങൾ, അടിസ്ഥാന ആശയങ്ങൾ, ഉപാശയങ്ങൾ, പിന്തുണാ സാമഗ്രികൾ, വിലയിരുത്തലുകൾ, ക്രോഡീകരണം, തുടർപ്രവർത്തനങ്ങൾ, റഫറൻസ് എന്നിവ ഉൾപ്പെടുന്നു.

പ്രൈമറിതലത്തിലെ അധ്യാപകവിദ്യാർത്ഥികളിൽ ഗണിതശാസ്ത്രത്തിലെ (പ്രൈമറിതലം) അടിസ്ഥാന ആശയങ്ങൾ ഉറപ്പിക്കുന്നതിന് അത് ഫലപ്രദമായി വിനിമയംചെയ്യാൻ അവരെ പ്രാപ്തരാക്കുകയും ചെയ്യുക എന്നതാണ് ഈ മൊഡ്യൂളുകൾ ലക്ഷ്യംവെയ്ക്കുന്നത്. അടിസ്ഥാന ഗണിതാശയങ്ങളെ ആഴത്തിൽ മനസ്സിലാക്കുന്നതിനും, അവയെക്കുറിച്ചുള്ള ധാരണ വികസിപ്പിക്കുന്നതിനും, അതിലൂടെ പ്രസ്തുത ഉള്ളടക്കം കുട്ടികൾക്ക് ലളിതമായി പഠിപ്പിക്കുന്നതിനും ഈ മൊഡ്യൂളുകൾ സഹായിക്കുന്നു. താഴെ കൊടുത്ത ക്രമത്തിലാണ് മൊഡ്യൂളുകൾ ഫ്രെയിം ചെയ്തിട്ടുള്ളത്.

1.	മൊഡ്യൂൾ - I	:	ഭിന്നസംഖ്യകൾ
2.	മൊഡ്യൂൾ - II	:	ശതമാനം
3.	മൊഡ്യൂൾ - III	:	ദശാംശസംഖ്യകൾ
4.	മൊഡ്യൂൾ - IV	:	അംശബന്ധം, അനുപാതം
5.	മൊഡ്യൂൾ - V	:	ജ്യാമിതി
6.	മൊഡ്യൂൾ - VI	:	ബീജഗണിതം

മൊഡ്യൂൾ - 1

ഭിന്നസംഖ്യകൾ

❑ ഉദ്ദേശ്യങ്ങൾ

1 . ഭിന്നസംഖ്യകളുടെ പ്രത്യേകതകളെക്കുറിച്ചും, വ്യത്യസ്ത ഭിന്നസംഖ്യകളെക്കുറിച്ചുമുള്ള ധാരണ വികസിപ്പിക്കുന്നതിന്.

2. ഭിന്നസംഖ്യകൾ തമ്മിലുള്ള ക്രിയകളുടെ പ്രത്യേകതകൾ തിരിച്ചറിയുന്നതിനും അവ പ്രയോഗിക്കുന്നതിനും.

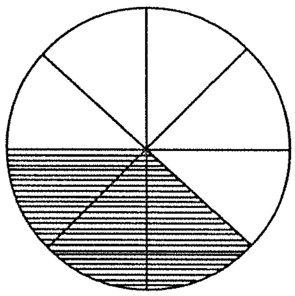
3. സമാനഭിന്നങ്ങളുടെ പ്രത്യേകത മനസ്സിലാക്കുന്നതിന്.

4. ഭിന്നസംഖ്യകളുടെ നൂതനസന്ദർഭങ്ങളിലുള്ള പ്രയോഗം അറിയുന്നതിന്.

നിർവചനം

ആകെയുള്ളതിന് തുല്യഭാഗങ്ങളാക്കിയതിൽ ഇത്രഭാഗം എന്ന് സൂചിപ്പിക്കുന്ന സംഖ്യയാണ് ഭിന്നസംഖ്യ.

ഉദാ : താഴെ കാണുന്ന വൃത്തത്തെ 8 തുല്യഭാഗങ്ങളാക്കിയതിൽ 3 ഭാഗം ഷെയ്ഡു ചെയ്തിരിക്കുന്നു.



അതായത്, മുഴുവന്റെ ഒരു പ്രത്യേക ഭാഗത്തെ ഭിന്നസംഖ്യ എന്ന് വിശേഷിപ്പിക്കുക.

x, y എന്നീ പൂർണ്ണസംഖ്യകളെ $\frac{x}{y}$ എന്ന രൂപത്തിൽ എഴുതാൻ സാധിക്കുകയും $y \neq 0$ ആകുകയും ചെയ്താൽ അത്തരം സംഖ്യകളാണ് ഭിന്നസംഖ്യകൾ. $\frac{x}{y}$ എന്ന രൂപത്തിൽ x എന്ന സംഖ്യയെ ഭിന്നസംഖ്യയുടെ അംശം (Numerator) എന്നും, y എന്ന സംഖ്യയെ ഭിന്നസംഖ്യയുടെ ഛേദം (Denominator) എന്നും പറയുന്നു.

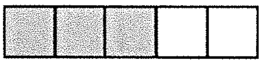
I. ഭിന്നസംഖ്യ - പ്രധാന വകഭേദങ്ങൾ

ഭിന്നസംഖ്യകളെ സാധാരണയായി താഴെ കൊടുത്ത രീതിയിൽ തരംതിരിക്കാം.

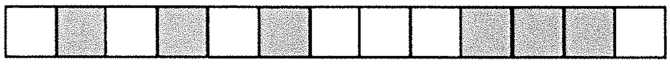
1. സാധാരണ ഭിന്നം (Proper Fraction)

ഒരു ഭിന്നസംഖ്യയുടെ അംശം, ഛേദത്തേക്കാൾ ചെറുതാണെങ്കിൽ അത്തരം ഭിന്നസംഖ്യകളെ സാധാരണ ഭിന്നം എന്നു പറയുന്നു. ഇതിന്റെ വില എല്ലായ്പ്പോഴും ഒന്നിൽ കുറവായിരിക്കും.

ഉദാ: $\frac{3}{5}$ ഉദാ: $\frac{6}{13}$



$\frac{3}{5}$



$\frac{6}{13}$

2. വിഷമഭിന്നം (Im-Proper Fraction)

ഒരു ഭിന്നസംഖ്യയുടെ അംശം ഛേദത്തേക്കാൾ വലുതാണെങ്കിൽ അത്തരം ഭിന്നസംഖ്യകളെ വിഷമഭിന്നം എന്നു പറയുന്നു.

ഉദാ: $\frac{4}{3}$, $\frac{5}{2}$

$\frac{1}{3}$ $\frac{1}{3}$ $\frac{1}{3}$ $\frac{1}{3}$

$= 4 \times \frac{1}{3}$, $\frac{4}{3}$

നാല് മൂന്നിലൊന്നുകൾ ചേർന്നതാണ് $\frac{4}{3}$

വിഷമഭിന്നത്തിന്റെ വില എല്ലായ്പ്പോഴും ഒന്നിൽ കൂടുതലായിരിക്കും.

3. മിശ്രഭിന്നം (Mixed Fraction)

ഒരു പൂർണ്ണസംഖ്യയും ഒരു സാധാരണഭിന്നത്തിന്റെ ഏറ്റവും ലഘൂകരിക്കപ്പെട്ട രൂപവും ചേർന്ന് വരുന്ന ഭിന്നസംഖ്യയാണ് മിശ്രഭിന്നങ്ങൾ.

- മിശ്രഭിന്നത്തെ വിഷമഭിന്നമായും, വിഷമഭിന്നത്തെ മിശ്രഭിന്നമായും മാറ്റി എഴുതാം.

ഉദാ : $3\frac{1}{4} = \frac{(4 \times 3) + 1}{4} = \frac{13}{4}$

$$\frac{13}{4} = \begin{array}{r|l} & 3 \\ \cline{2-2} 4 & 13 \\ & 12 \\ \cline{2-2} & 1 \end{array} = 3\frac{1}{4}$$

- ഒരു മിശ്രഭിന്നത്തിന്റെ വില എല്ലായ്പ്പോഴും ഒന്നിൽ കൂടുതലായിരിക്കും.

II. ഭിന്നസംഖ്യകൾ - കൂടുതൽ വസ്തുതകൾ

(i) ഒരു ഭിന്നസംഖ്യയുടെ അംശത്തെയും ഛേദത്തെയും ഒരേ സംഖ്യകൊണ്ട് ഗുണിക്കുകയോ ഹരിക്കുകയോ ചെയ്താൽ പ്രസ്തുത ഭിന്നസംഖ്യയുടെ വിലക്ക് യാതൊരു വ്യത്യാസവും ഉണ്ടാകുന്നില്ല. അതേസമയം, കൂട്ടുകയോ, കുറയ്ക്കുകയോ ചെയ്യുമ്പോൾ ഭിന്നസംഖ്യയിൽ വ്യത്യാസം വരുന്നു.

ഉദാ: $\frac{4 \times 2}{3 \times 2} = \frac{8}{6}$

(ii) ഒരു വിഷമഭിന്നത്തെ മിശ്രഭിന്നമാക്കുന്നതിന്, ആ വിഷമഭിന്നത്തിന്റെ അംശത്തെ ഛേദം കൊണ്ട് ഹരിച്ചാൽമതി.

(iii) മിശ്രഭിന്നത്തെ വിഷമഭിന്നമാക്കുമ്പോൾ ഛേദത്തിന് വ്യത്യാസം വരുന്നില്ല.

4. **ഭിന്നങ്ങളുടെ ഭിന്നം (Compound Fraction or Fraction of fraction)**

ഒരു ഭിന്നസംഖ്യയുടെ ഭിന്നഭാഗത്തെ ഭിന്നങ്ങളുടെ ഭിന്നം എന്നു പറയുന്നു.

ഉദാ : $\frac{2}{3}$ ന്റെ $\frac{4}{5}$ ഭാഗം = $\frac{2}{3} \times \frac{4}{5} = \frac{8}{15}$

5. **സങ്കീർണ്ണ ഭിന്നങ്ങൾ (Compound Fraction)**

ഒരു ഭിന്നസംഖ്യയുടെ അംശമോ അല്ലെങ്കിൽ ഛേദമോ, അതുമല്ലെങ്കിൽ രണ്ടും വീണ്ടും ഭിന്നസംഖ്യകളായി വരികയാണെങ്കിൽ അത്തരം ഭിന്നസംഖ്യകളാണ് സങ്കീർണ്ണസംഖ്യകൾ.

ഉദാ: $\frac{\left(\frac{2}{3}\right)}{5}$, $\frac{6}{\left(\frac{7}{11}\right)}$, $\left(\frac{7}{11}\right) \Big/ \left(\frac{9}{11}\right)$

6. **ഏകഭിന്നങ്ങൾ (Unit Fraction)**

ഉദാ: $\frac{1}{5}$, $\frac{1}{10}$, $\frac{1}{25}$ ....

7. **സമാനഭിന്നങ്ങൾ**

ഒരു ഭിന്നസംഖ്യയുടെ അംശത്തെയും ഛേദത്തെയും ഒരേ സംഖ്യകൊണ്ട് ഗുണിക്കുകയോ, ഹരിക്കുകയോ ചെയ്യുമ്പോൾ സമാനഭിന്നങ്ങൾ ലഭിക്കുന്നു.

ഉദാ: $\frac{2}{3} = \frac{2 \times 4}{3 \times 4} = \frac{8}{12}$

ഭിന്നസംഖ്യ സങ്കലന, വ്യവകലന ക്രിയകളിൽ <u>ല.സ.ഗു. രീതിക്ക് പകരം സമാനഭിന്ന രീതി</u> ഉപയോഗിക്കാം.

ഉദാ: $\frac{1}{4} + \frac{2}{3} = \frac{3}{12} + \frac{8}{12} = \frac{11}{12} = \frac{11}{12}$

III. ഭിന്നസംഖ്യകളുടെ സങ്കലനവും വ്യവകലനവും

(i) ഭിന്നസംഖ്യകളുടെ സങ്കലനം

അളവുകളെ സൂചിപ്പിക്കുന്നതിനാണ് ഭിന്നസംഖ്യകൾ. ഇത്തരം അളവുകളിൽനിന്ന് പല രീതിയിൽ മറ്റു അളവുകൾ ഉണ്ടാക്കുന്നതിന്റെ ഗണിതക്രിയകളാണ് ഭിന്നസംഖ്യകൾ ഉപയോഗിച്ചുള്ള ക്രിയകളുടെ അടിസ്ഥാനം.

ഉദാ : ഒരു നിശ്ചിത നീളത്തിന്റെ പകുതിനീളമുള്ള വടിയും മൂന്നിലൊന്നു നീളമുള്ള വടിയും അറ്റത്തോടറ്റം ചേർത്ത് വെച്ചാൽ ആകെ എത്ര നീളം ?

ഈ ചോദ്യത്തിന്റെ ഉത്തരം വിശകലനം ചെയ്താൽ നിശ്ചിത നീളത്തിന്റെ ആറിലൊന്ന് ഉപയോഗിച്ച് അളന്നാൽ, ആദ്യത്തെ ചരടിന്റെ നീളം മൂന്ന്, രണ്ടാമത്തേതിന്റെ രണ്ട്, ആകെ അഞ്ച്, അഞ്ച് ആറിലൊന്നുകൾ എന്നാൽ ആറിലഞ്ച്.

ഗണിതരൂപത്തിൽ പറഞ്ഞാൽ

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

അതായത്, ഭിന്നങ്ങളുടെ സങ്കലനത്തിൽ

$\frac{a}{b} + \frac{c}{d} = \frac{ad + bc}{bd}$ എന്ന ബീജഗണിത വാക്യം രൂപീകരിക്കാം.

- സമാന ഛേദമുള്ള ഭിന്നസംഖ്യകളുടെ തുക കാണാൻ അവയുടെ അംശങ്ങൾ പരസ്പരം കൂട്ടി എഴുതിയാൽ മതി.

ഉദാ: $\frac{4}{7} + \frac{11}{7} = \frac{15}{7}$

- ഭിന്നസംഖ്യകളുടെ ഛേദങ്ങൾ വ്യത്യസ്തങ്ങളാണെങ്കിൽ

(i) ഛേദങ്ങൾ പരസ്പരം ഘടകങ്ങളാണെങ്കിൽ അതിലെ വലിയ സംഖ്യയാണ് ഛേദങ്ങളുടെ ചെറു പൊതുഗുണിതം (LCM).

(ii) ഛേദങ്ങൾ പരസ്പരം ഘടകങ്ങളല്ലെങ്കിൽ, തീർത്തും വ്യത്യസ്ത സംഖ്യകളാണെങ്കിൽ അവയുടെ ഗുണനഫലമായിരിക്കും. ഛേദങ്ങളുടെ ചെറു പൊതുഗുണിതം (LCM).

ഉദാ : $\frac{5}{7} + \frac{6}{5} = \frac{25 + 42}{35} = \frac{67}{35}$

മറ്റൊരു രീതി :-

ഛേദങ്ങൾ തുല്യമാക്കി തുക കാണുന്നതിന് ഉദാഹരണം

$\frac{4}{7} + \frac{5}{21}$ ചെ. പൊ. ഗു = 21

$$= \frac{4}{7} \times \frac{3}{3} + \frac{5}{21} \times \frac{1}{1} = \frac{12}{21} + \frac{5}{21} = \frac{17}{21}$$

- **മിശ്രഭിന്നങ്ങളുടെ തുക കാണുന്ന വിധം**

  മിശ്രഭിന്നങ്ങളുടെ തുക കാണുന്നതിന്, അവയെ വിഷമഭിന്നങ്ങളാക്കിയ ശേഷം നേരത്തെ പ്രതിപാദിച്ച രീതിയിൽ ക്രിയചെയ്യുക.

  ഉദാ: $1\frac{1}{3} + 2\frac{1}{4}$

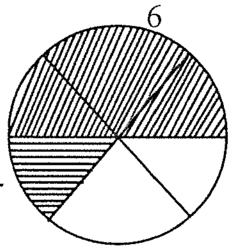
  വിഷമഭിന്നമാക്കുമ്പോൾ $= \frac{4}{3} + \frac{9}{4}$

  ഛേദങ്ങളുടെ പൊ.പൊ.ഗു. $= 12$

  $= \frac{4}{3} \times \frac{4}{4} + \frac{9}{4} \times \frac{3}{3}$

  $= \frac{16}{12} + \frac{27}{12} = \frac{16+27}{12} = \frac{43}{12} = 3\frac{7}{12}$

ഭിന്നസംഖ്യകളുടെ തുക ചിത്രീകരണത്തിൽ



ചിത്രത്തിൽ $\frac{3}{6} + \frac{1}{6} = \frac{4}{6}$

2. **ഭിന്നസംഖ്യകളുടെ വ്യവകലനം**

- ഭിന്നസംഖ്യകളുടെ സങ്കലനത്തിലെ നിയമങ്ങളാണ് വ്യവകലനത്തിനും ഉപയോഗിക്കുന്നത്.

  ഉദാ: (i) $\frac{3}{4} - \frac{2}{7}$

  $= \frac{3}{4} \times \frac{7}{7} - \frac{2}{7} \times \frac{4}{4} = \frac{21}{28} - \frac{8}{28} = \frac{21-8}{28} = \frac{13}{28}$

  (ii) ഒന്നേമുക്കാൽ മീറ്റർ നീളമുള്ള ചരടിൽനിന്ന് അരമീറ്റർ മുറിച്ച് മാറ്റിയാൽ, മിച്ചമുള്ള ചരടിന്റെ നീളം എത്രയാണ് ?

  മിച്ചമുള്ള ചരടിന്റെ നീളം $1\frac{3}{4} - \frac{1}{2}$

  $= 1 + \frac{3}{4} - \frac{1}{2}$

  $= 1 + \frac{3}{4} - \frac{1}{2}$

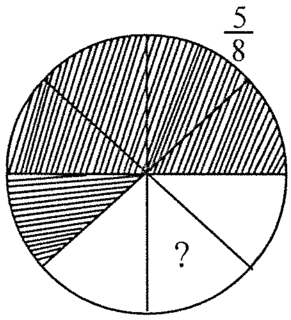
  $= 1 + \left(\frac{3}{4} - \frac{1}{2}\right) = 1 + \frac{1}{4} = 1\frac{1}{4}$ മീറ്റർ

(iii) മൂന്നര കിലോഗ്രാം മത്തങ്ങയിൽ നിന്ന് ഒന്നേമുക്കാൽ കിലോഗ്രാം മുറിച്ചെടുത്തു. ബാക്കിയുള്ള കഷണം എത്ര കിലോ?

ബാക്കിയുള്ള കഷണം $= 3\frac{1}{2} - 1\frac{3}{4} = \frac{7}{2} - \frac{7}{4}$

$= \frac{14}{4} - \frac{7}{4} = \frac{7}{4} = 1\frac{3}{4}$ കിലോ

eg:



ചിത്രത്തിൽ ഇനി നിറം കൊടുക്കാനുള്ള ഭാഗം

$= 1 - \frac{5}{8} = \frac{8}{8} - \frac{5}{8} = \frac{3}{8}$

IV. ഭിന്നസംഖ്യകളുടെ ഗുണനം

ഒരു മുഴുവന്റെ ഭാഗത്തിന്റെ ഭാഗം കണ്ടുപിടിക്കുന്ന ക്രിയയെ ആണ് ഭിന്നസംഖ്യകളുടെ ഗുണനമായി കരുതുന്നത്.

അതായത് ഉദാഹരണമായി $\frac{2}{3}$ ന്റെ $\frac{4}{5}$ ഭാഗം $= \frac{2}{3} \times \frac{4}{5} = \frac{8}{15}$ ഭാഗം

മറ്റൊരു രീതി

$12 \times \frac{1}{4}$ = 12 ന്റെ നാലിലൊരു ഭാഗം = $12 \times \frac{1}{4} = 3$

= 12 ന്റെ $\frac{1}{4}$ ഭാഗം $= 3$

- ഭിന്നസംഖ്യകളുടെ ഗുണനഫലം കാണുവാൻ അംഗങ്ങളെ പരസ്പരം ഗുണിച്ച് അംശമായും, ഛേദങ്ങളെ പരസ്പരം ഗുണിച്ച് ഛേദമായും എഴുതിയാൽ മതി.

  ഉദാ : $\frac{3}{8} \times \frac{4}{7}$, $\frac{3 \times 4}{8 \times 7} = \frac{12}{56}$

- മിശ്രഭിന്നങ്ങളാണെങ്കിൽ, അവയെ വിഷമഭിന്നമടങ്ങിയ ശേഷം മുകളിൽ പറഞ്ഞപ്രകാരം ക്രിയചെയ്താൽ മതി.

  ഉദാ : $6\frac{2}{3} \times 7\frac{1}{4}$, $\frac{20}{3} \times \frac{29}{4} = \frac{20 \times 29}{3 \times 4} = \frac{580}{12}$

V. ഭിന്നസംഖ്യകളുടെ ഹരണം

ഒരു സംഖ്യയെ ഏത് സംഖ്യകൊണ്ട് ഗുണിച്ചാൽ 1 ലഭിക്കുന്നുവോ ആ സംഖ്യയെ ആദ്യത്തേതിന്റെ വ്യുൽക്രമം (reciprocal) എന്നു പറയുന്നു.

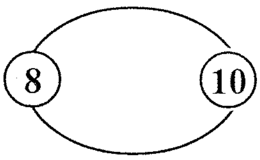
ഉദാ : $\frac{2}{5}$ ന്റെ എത്ര മടങ്ങാണ് 1 ?

- $\frac{2}{5}$ കൾ 2 എണ്ണം ചേർന്നാൽ $\frac{4}{5}$ ആകും.
- 1 ആകാൻ ഇനി എത്ര $\frac{1}{5}$ കൂടി വേണം.
- $\frac{1}{5}$ എന്നത് $\frac{2}{5}$ ന്റെ പകുതിയാണ്. $\left(\frac{1}{2}\right.$ ഭാഗമാണ്$\left.\right)$
- അപ്പോൾ 1 ആകാൻ $\frac{2}{5}$ ന്റെ 2 മടങ്ങും $\frac{1}{2}$ ഭാഗവും വേണം.
- അതായത് $2\frac{1}{2}$ മടങ്ങ് = $\frac{2}{5}$ ന്റെ $2\frac{1}{2}$ മടങ്ങ്

$$\frac{3}{2} \times \frac{4}{5} = \frac{12}{10} = 1\frac{1}{5}$$ മടങ്ങ്

വിശദീകരണം

$\frac{5}{4}$ മടങ്ങ്



$\frac{4}{5}$ ഭാഗം

ഇവിടെ 8ന്റെ $\frac{5}{4}$ മടങ്ങാണ് 10, അതായത് 10ന്റെ $\frac{4}{5}$ ഭാഗമാണ് 8.

ഇപ്രകാരം ഭിന്നസംഖ്യകൾ തമ്മിലുള്ള വിവരണം വ്യുൽക്രമിക ഗുണനമാണ്.

ഉദാ : $\frac{4}{6} \div \frac{3}{8} = \frac{4}{6} \times \frac{8}{3} = \frac{32}{18}$

VI. ഭിന്നസംഖ്യകളുടെ താരതമ്യം

- 2 ഭിന്നസംഖ്യകൾ തമ്മിൽ താരതമ്യം ചെയ്യുന്നതിന് ഒന്നാം ഭിന്നസംഖ്യയുടെ അംശവും, രണ്ടാം ഭിന്നസംഖ്യയുടെ ഛേദവും തമ്മിലും, തുടർന്ന് ഒന്നാം ഭിന്നസംഖ്യയുടെ ഛേദവും, രണ്ടാംദിന സംഖ്യയുടെ അംശവും തമ്മിലും ഗുണിക്കുക.
- ഒന്നാം ഗുണനഫലമാണ് വലുതെങ്കിൽ ഒന്നാം ഭിന്നസംഖ്യയാണ് വലിയ ഭിന്ന സംഖ്യ.

- രണ്ടാം ഗുണനഫലാണ് വലുതെങ്കിൽ, രണ്ടാം ഭിന്നസംഖ്യയാണ് വലിയ ഭിന്നസംഖ്യ.

ഉദാ: $\frac{1}{6}$, $\frac{3}{8}$ എന്നിവ താരതമ്യംചെയ്യുക.

$1 \times 8 = 8$
$6 \times 3 = 18$

ഇവിടെ രണ്ടാം ഗുണനഫലമാണ് വലുതെന്നതിനാൽ രണ്ടാമത്തെ ഭിന്നസംഖ്യയായ $\frac{3}{8}$ ആണ് വലിയ ഭിന്നസംഖ്യ.

- തന്നിട്ടുള്ള ഭിന്നസംഖ്യകൾക്ക് ഒരേ അംശങ്ങളാണെങ്കിൽ വലിയ ഛേദമുള്ള ഭിന്ന സംഖ്യ ചെറുതും ചെറിയ ഛേദമുള്ള ഭിന്നസംഖ്യ വലുതുമായിരിക്കും.
- തന്നിട്ടുള്ള ഭിന്നസംഖ്യകൾക്ക് ഒരേ ഛേദമാണെങ്കിൽ ചെറിയ അംശമുള്ള ഭിന്ന സംഖ്യ ചെറുതും, വലിയ ആരമുള്ള ഭിന്നസംഖ്യ വലുതുമായിരിക്കും.

ICT - Integration

1. J Fraction Lab - Free style option.
2. ഭാഗത്തിന്റെ ഭാഗം - Ubuntu School Resources. (Std. VI)

ക്രോഡീകരണം

- ഒരു മുഴുവൻഭാഗത്തെ തുല്യഭാഗങ്ങളാക്കിയതിൽ ഇത്രഭാഗം എന്ന് സൂചിപ്പിക്കുന്ന സംഖ്യ യാണ് ഭിന്നസംഖ്യ.
- ഭിന്നസംഖ്യകൾ സാധാരണഭിന്നം, വിഷമഭിന്നം, മിശ്രഭിന്നം എന്നിങ്ങനെ സാധാരണയായി തരംതിരിക്കാം.
- ഒരു ഭിന്നസംഖ്യയും അംശത്തെയും ഛേദത്തെയും ഒരു നിശ്ചിത സംഖ്യകൊണ്ട് ഗുണി ക്കുമ്പോഴോ, ഹരിക്കുമ്പോഴോ ലഭിക്കുന്ന ഭിന്നസംഖ്യയാണ് സമാനഭിന്നങ്ങൾ.
- ഭിന്നസംഖ്യകളുടെ തുകയ്ക്കും, വ്യത്യാസങ്ങൾക്കും ചെറു പൊതുഗുണിതം (LCM) അല്ലെ ങ്കിൽ സമാനഭിന്നം എന്ന ആശയം ഉപയോഗിക്കാം.
- ഭാഗങ്ങളെയും മടങ്ങുകളെയും ഭിന്നസംഖ്യകളുടെ ഗുണനമായി വ്യാഖ്യാനിക്കുന്നു.
- ഭിന്നസംഖ്യകളുടെ ഗുണനഫലത്തെ ഭാഗത്തിന്റെ ഭാഗമായി വ്യാഖ്യാനിച്ച് ഗുണനഫലം കണ്ടെത്തുന്നു.
- ഭാഗമോ, മടങ്ങോ തിരിച്ചുപറയാൻ വ്യുൽക്രമം എന്ന ആശയം ഉപയോഗിക്കുന്നു.
- വ്യുൽക്രമംകൊണ്ടുള്ള ഗുണനത്തെ ഹരണമായി വ്യാഖ്യാനിക്കുന്നു.

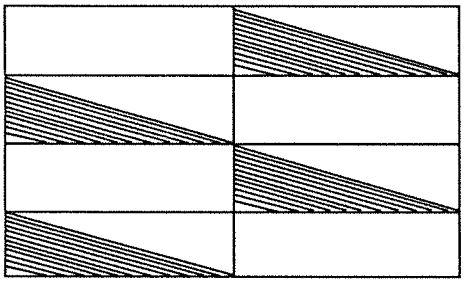
തുടർപ്രവർത്തനങ്ങൾ

1. താഴെ കൊടുത്ത ഭിന്നസംഖ്യകളെ മിശ്രഭിന്നരൂപത്തിലെഴുതുക.

   (i) $\frac{20}{3}$ (ii) $\frac{11}{5}$ (iii) $\frac{25}{7}$

2. $\frac{42}{28}$ നെ ലഘുരൂപത്തിലെഴുതുക.

3.



ചിത്രത്തിലെ ഷെയ്ഡുചെയ്ത ഭാഗത്തിന്റെ സംഖ്യ എഴുതുക.

4. **ക്രിയചെയ്യുക**

(i) $2\frac{2}{3} + 1\frac{1}{3}$

(ii) $\frac{7}{5} + \frac{4}{7} - \frac{3}{8}$

(iii) $\frac{13}{20} \times \frac{25}{16} \times \frac{5}{4}$

(iv) $\frac{3}{7}$ ന്റെ എത്ര മടങ്ങാണ് 1 ?

(v) 16 മീറ്റർ നീളമുള്ള കമ്പി $\frac{2}{3}$ മീറ്റർ നീളമുള്ള കഷണങ്ങളാക്കിയാൽ എത്ര കഷണങ്ങളുണ്ടാകും?

(vi) $5\frac{1}{4}$ ലിറ്റർ വെള്ളം $\frac{3}{4}$ ലിറ്റർ കൊള്ളുന്ന കുപ്പികളിലാക്കണം. എത്ര കുപ്പി വേണം?

Reference :

(i) Text books of Std. V, VI, VIII - SCERT (2013)

(ii) Hand books of Std. V, VI, VII - SCERT (2014) (teacher text)

മൊഡ്യൂൾ - 2

ശതമാനം

ആമുഖം

നിത്യജീവിതവുമായി ബന്ധപ്പെട്ട പ്രധാന മേഖലയിലെല്ലാം ഉപയോഗിക്കാറുള്ള ഗണിതശാഖയാണ് ശതമാനം. വാണിജ്യം, വ്യവസായം, ബാങ്കിംഗ്, ഇൻഷൂറൻസ് ഓഹരി, ഗവേഷണം തുടങ്ങിയ മിക്ക മേഖലയിലെല്ലാം ശതമാനം ഉപയോഗിച്ചുവരുന്നു. പ്രസ്തുത ഗണിതാശയത്തെ പ്രതിപാദിക്കുന്നതാണ് ഈ മൊഡ്യൂൾ.

ലക്ഷ്യങ്ങൾ

1. ശതമാനം എന്ന ആശയത്തെ അടിസ്ഥാനപരമായി മനസ്സിലാക്കുന്നതിന്.
2. വിവിധ സന്ദർഭങ്ങളിൽ ശതമാനത്തിന്റെ പ്രയോഗത്തെക്കുറിച്ചുള്ള ധാരണ നേടുന്നതിന്.

പ്രധാന ആശയങ്ങൾ

- ഒരു വസ്തുതയെ 100 എന്ന സംഖ്യയുമായി ബന്ധിപ്പിച്ചു പറയുമ്പോൾ ആ പ്രസ്താവന ശതമാനത്തിലായി എന്നുപറയുന്നു. ശതമാനം എന്നാൽ നൂറിനെ അടിസ്ഥാനമാക്കിയുള്ള അളവ്. അതായത് ശതമാനം എന്ന വാക്കിനെ രണ്ടായി പിരിച്ചാൽ ശതം = നൂറ്, മാനം = അളവ് എന്നാണ്. ശതമാനത്തെ സൂചിപ്പിക്കുന്നതിന് % എന്ന ചിഹ്നം ഉപയോഗിക്കുന്നു.
- x % എന്നാൽ $\frac{x}{100}$ എന്നാണ് അർത്ഥം. അതായത് ഏതൊരു ശതമാനസംഖ്യയെയും ഭിന്നസംഖ്യയായി എഴുതാൻ ഛേദമായി 100 ചേർത്താൽ മതി.
- ഭിന്നസംഖ്യയെയും ദശാംശസംഖ്യയെയും ശതമാനമാക്കി മാറ്റാൻ അവയെ 100 കൊണ്ട് ഗുണിച്ചാൽ മതി.

ഉദാ :- $\frac{1}{2} \times 100\% = 50\%$ $\qquad$ $\frac{3}{4} \times 100\% = 75\%$

$0.7 \times 100\% = 70\%$ $\qquad$ $0.65 \times 100\% = 65\%$

ഭിന്നസംഖ്യകളും അവയ്ക്ക് തുല്യമായ ശതമാനവും

ഭിന്നസംഖ്യ	ശതമാനം
$\frac{3}{4}$	75%
$\frac{1}{4}$	25%
$\frac{1}{16}$	$6\frac{1}{4}\%$
$\frac{1}{32}$	$3\frac{1}{8}\%$
$\frac{2}{3}$	$66\frac{2}{3}\%$

ഭിന്നസംഖ്യ	ശതമാനം
$\frac{1}{12}$	$8\frac{1}{3}\%$
$\frac{1}{10}$	10%
$\frac{1}{100}$	1 %
$\frac{1}{3}$	$33\frac{1}{3}\%$
$\frac{1}{2}$	50%

ഭിന്നസംഖ്യ	ശതമാനം
$\frac{1}{8}$	$12\frac{1}{2}\%$
$\frac{1}{32}$	$3\frac{1}{8}\%$
$\frac{1}{6}$	$16\frac{2}{3}\%$
$\frac{1}{5}$	20 %
$\frac{1}{20}$	5 %

ഭിന്നസംഖ്യ	ശതമാനം
$\frac{1}{25}$	4%
$\frac{18}{25}$	72%
$\frac{18}{50}$	36 %

ഉദാഹരണങ്ങൾ

(i) ഒരു സംഖ്യയുടെ 20% 300 ആയാൽ സംഖ്യ ഏത്? ഇവിടെ സംഖ്യ x എന്ന് സങ്കൽപ്പിച്ചാൽ -

x ന്റെ 20% = 300

$$x \times \frac{20}{100} = 300$$

$$\therefore x = \frac{300 \times 100}{20} = 1500$$

(ii) 40 എന്ന സംഖ്യ 60 മാറിയാൽ വർദ്ധനവ് എത്ര ശതമാനം? വർദ്ധന തുക = 20,

അതായത് $\frac{20}{40} \times 100 = 50\%$

(iii) 100 എന്ന സംഖ്യ 60 ആയി കുറഞ്ഞു. കുറവ് എത്ര ശതമാനം?

കുറഞ്ഞ തുക = 40, അതായത് $\frac{40}{100} \times 100 = 40\%$

A എന്ന സംഖ്യ x % വർദ്ധിച്ചാൽ പുതിയ സംഖ്യ A യുടെ (100 + x)% വും A എന്ന സംഖ്യ x % കുറഞ്ഞാൽ പുതിയ സംഖ്യ A യുടെ (100 − x)% വും ആയിരിക്കും.

ഉദാ : 1. 600 എന്ന സംഖ്യ അതിന്റെ 10% കൂടി വർദ്ധിച്ചാൽ എത്രയാകും ?

വിശകലനം

ആദ്യം 600ന്റെ 10% $\Rightarrow 600 \times \frac{10}{100} = 60$

$\therefore$ പുതിയ സംഖ്യ = 600 + 60 = 660

2. ഒരു സംഖ്യ അതിന്റെ 25% കൂടി വർദ്ധിച്ചപ്പോൾ 4000 ആയി. എങ്കിൽ സംഖ്യ എത്ര ?

സംഖ്യ x എന്ന് സങ്കൽപ്പിക്കുക

അതായത്, $x \times \frac{125}{100} = 4000 \quad \therefore x = 4000 \times \frac{100}{125} = 3200$

ശതമാനം പ്രയോഗത്തിൽ

നിത്യജീവിതത്തിൽ ഒട്ടേറെ സന്ദർഭങ്ങളിൽ ശതമാനം ഉപയോഗിക്കുന്നു.

ലാഭനഷ്ടങ്ങൾ, ഡിസ്ക്കൗണ്ട് എന്നിവ ഉദാഹരണങ്ങളാണ്.

- ലാഭം = വിറ്റവില − വാങ്ങിയ വില
- നഷ്ടം = വാങ്ങിയവില − വിറ്റ വില
- ലാഭശതമാനം = $\dfrac{\text{ലാഭം}}{\text{വാങ്ങിയ വില}} \times 100$
- നഷ്ടശതമാനം = $\dfrac{\text{നഷ്ടം}}{\text{വാങ്ങിയ വില}} \times 100$
- വിറ്റവില = $\dfrac{\text{വാങ്ങിയ വില} \times (100 + \text{ലാഭശതമാനം})}{100}$
- വിറ്റവില = $\dfrac{\text{വാങ്ങിയ വില} \times (100 - \text{ലാഭശതമാനം})}{100}$
- ഡിസ്കൗണ്ട് = പരസ്യവില − വിറ്റവില
- ഡിസ്കൗണ്ട് ശതമാനം = $\dfrac{\text{ഡിസ്കൗണ്ട്}}{\text{പരസ്യവില}} \times 100$
- ശതമാനത്തെ ചിത്രീകരിക്കുന്നതിന് പൈ ഡയഗ്രം ഉപയോഗിക്കാം.

ഉദാഹരണങ്ങൾ :

(i) 100 രൂപയ്ക്ക് 11 പേന വാങ്ങി. 10 പേന 110 രൂപയ്ക്ക് വിറ്റാൽ ലാഭശതമാനം എത്ര?

വിശകലനം

11 പേനയുടെ വാങ്ങിയ വില = 100 രൂപ

10 പേനയുടെ വിറ്റ വില = 110 രൂപ

$\therefore$ 1 പേനയുടെ വിറ്റവില = $\dfrac{110}{10}$ = 11 രൂപ

$\therefore$ 11 പേന വിൽക്കുമ്പോൾ ലഭിക്കുന്ന ലാഭം = 121 − 100 = 21 രൂപ

$\therefore$ ലാഭശതമാനം = $\dfrac{\text{ലാഭം}}{\text{വാങ്ങിയ വില}} \times 100 = \dfrac{21}{100} = 100$

= 21%

(ii) ഒരു പുസ്തകം വാങ്ങുമ്പോൾ അതേ വിലയുള്ള മറ്റൊന്ന് സൗജന്യമായി ലഭിച്ചാൽ ഡിസ്ക്കൗണ്ട് എത്ര ശതമാനം ?

വിശകലനം

ഇവിടെ 2 പുസ്തകം കിട്ടുമ്പോൾ അതിലൊന്ന് സൗജന്യമാണ് എന്ന് കരുതണം.

$\therefore$ ഡിസ്ക്കൗണ്ട് ശതമാനം = $\dfrac{1}{2} \times 100 = 50\%$

ക്രോഡീകരണം

- ഒരു വസ്തുതയെ 100 എന്ന സംഖ്യയുമായി ബന്ധിപ്പിച്ചു പറയുമ്പോൾ അല്ലെങ്കിൽ നൂറിലെത്ര എന്ന് സൂചിപ്പിക്കുമ്പോഴാണ് പ്രസ്തുത വസ്തുത ശതമാനത്തിലായി എന്ന് പറയുന്നത്.
- മുഴുവൻ എന്ന് പറയുന്നത് 100% ആണ്.
- 20% കാണാൻ സംഖ്യയുടെ $\frac{1}{5}$ ഭാഗവും 75% കാണാൻ സംഖ്യയുടെ $\frac{3}{4}$ ഭാഗവും കണ്ടാൽ മതി.
- 200% എന്നാൽ ഇരട്ടി ശതമാനം എന്നും, 300% എന്നാൽ മൂന്നിരട്ടി ശതമാനവും എന്നുമാണ്.
- ഒരു സംഖ്യയുടെ 1% കാണാൻ സംഖ്യയുടെ $\frac{1}{100}$ ഭാഗം എടുത്താൽ മതി.

ICT Slot : Ubuntu → Chart → Pie diagram

തുടർപ്രവർത്തനങ്ങൾ

1. 64ന്റെ 20% എത്ര ?
2. 36ന്റെ എത്ര ശതമാനമാണ് 9 ?
3. 30 പേർ പരീക്ഷ എഴുതിയാൽ 6 പേർ തോറ്റു. എങ്കിൽ വിജയശതമാനം എത്ര ?
4. 12 പേനകൾ വാങ്ങിയപ്പോൾ 1 പേന സൗജന്യമായി കൊടുത്തു. എങ്കിൽ ഡിസ്കൗണ്ട് എത്ര ശതമാനം ?
5. ഒരു സംഖ്യ, അതിന്റെ 12% കൂടി വർദ്ധിച്ചപ്പോൾ 896 ആയി. എങ്കിൽ ആദ്യസംഖ്യ ഏത്?

Reference :

(i) Text books of Std. VII - SCERT (2013)

(ii) ഗണിതകൗതുകം - കേരള ശാസ്ത്രസാഹിത്യ പരിഷത്ത് (2000)

മൊഡ്യൂൾ - 3

ദശാംശസംഖ്യകൾ

❑ ആമുഖം

സംഖ്യകളെയും ഭിന്നസംഖ്യകളെയും സ്ഥാനവില രീതിയിൽ എഴുതാനുള്ള ശ്രമത്തിനിടയിൽ, ഭിന്നസംഖ്യകളെ സ്ഥാനവില രീതിയിൽ എഴുതാൻ പ്രയാസം വന്നു. ഈ സന്ദർഭത്തിൽ 13-ാം നൂറ്റാണ്ടിൽ ചൈനീസ് ഗണിതശാസ്ത്രജ്ഞനായ യാങ്ഹൂയി ആണ് ദശാംശഭിന്നങ്ങളുടെ ക്രിയ ആദ്യമായി ചെയ്തത്.

❑ ലക്ഷ്യങ്ങൾ

1. ദശാംശസംഖ്യകളുടെ അടിസ്ഥാന ആശയങ്ങൾ മനസ്സിലാക്കുന്നതിന്.
2. ദശാംശസംഖ്യകൾ ഉൾപ്പെടുന്ന പ്രായോഗിക പ്രശ്നങ്ങൾ പരിഹരിക്കുന്നതിനുള്ള ശേഷി നേടുന്നതിന്.

❑ അടിസ്ഥാനാശയങ്ങൾ

1. 10, 100, 1000 തുടങ്ങിയവ ഛേദമായി വരുന്ന ഭിന്നസംഖ്യകളെയാണ് ദശാംശ സംഖ്യ എന്ന് പറയുന്നത്.
2. എല്ലാ ദശാംശസംഖ്യകളെയും ഭിന്നസംഖ്യകളായും, എല്ലാ ഭിന്നസംഖ്യകളെയും ദശാംശസംഖ്യകളായും മാറ്റി എഴുതാൻ സാധിക്കും.
3. ഒരു ഭിന്നസംഖ്യയുടെ ദശാംശരൂപത്തിൽ ദശാംശത്തിന് ശേഷം അക്കങ്ങൾ ആവർത്തിക്കുകയാണെങ്കിൽ അവയെ ആവർത്തക ദശാംശങ്ങൾ എന്ന് പറയുന്നു.

   ഉദാ : $\frac{1}{3} = 0.3333...$

   $\frac{1}{7} = 0.142857142857...$

4. ദശാംശസംഖ്യക്ക് 2 ഭാഗങ്ങളുണ്ട്. (1) അഖണ്ഡസംഖ്യാഭാഗം (Whole Part) (2) ദശാംശഭിന്നം (Decimal Part).

   - ദശാംശബിന്ദുവിന് മുൻപുള്ള ഭാഗമാണ് അഖണ്ഡസംഖ്യാഭാഗം.
   - ദശാംശബിന്ദുവിന് ശേഷമുള്ള ഭാഗമാണ് ദശാംശഭിന്നം.

   ഉദാ : 124.375 എന്ന സംഖ്യയിൽ

   അഖണ്ഡസംഖ്യാ ഭാഗം = 124

   ദശാംശഭിന്നം = 0.375

<u>ദശാംശസംഖ്യകളുടെ അടിസ്ഥാന ക്രിയകൾ</u>

- 2 ദശാംശസംഖ്യകൾ കൂടുകയോ കുറക്കുകയോ ചെയ്യുന്നതിന് അവയുടെ ദശാംശസ്ഥാനങ്ങളുടെ എണ്ണം തുല്യമാക്കണം.

വിശകലനം

ഉദാ : 528 + 52.8 + 5.28 + 0.528

```
528.000
 52.800
  5.280
  0.528
-----------
586.608
=======
```

വ്യവകലനം

ഉദാ : 25.8 – 7.025

```
25.8000
 7.0250
-----------
18.7750
=======
```

ഗുണനം

രണ്ട് ദശാംശസംഖ്യകൾ തമ്മിൽ ഗുണിക്കുന്നതിന്, സംഖ്യകളെ മാത്രം ഗുണിച്ചതിന് ശേഷം മൊത്തം ദശാംശസ്ഥാനങ്ങളുടെ എണ്ണം ഗുണനഫലത്തിൽ ഇടത്തോട്ട് മാറ്റി ദശാംശ ബിന്ദു ഇട്ടാൽ മതി.

ഉദാ : $2.5 \times 4 = 1.00$

ഹരണം

ഒരു ദശാംശസംഖ്യയെ മറ്റൊരു ദശാംശസംഖ്യകൊണ്ട് ഹരിക്കുമ്പോൾ ഹാരകം (ഛേദം) എപ്പോഴും പൂർണ്ണസംഖ്യയായിരിക്കണം. ഹാരകത്തെ പൂർണ്ണസംഖ്യയാക്കുന്നതിന്, ദശാംശസ്ഥാനങ്ങളുടെ എണ്ണത്തിനനുസരിച്ച് 10, 100... മുതലായ അനുയോജ്യമായ സംഖ്യകൊണ്ട് ഹാര്യത്തെയും ഹാരകത്തെയും ഗുണിച്ചാൽ മതി.

ശേഷം ഹാര്യത്തിലെ ദശാംശസ്ഥാനങ്ങൾക്കനുസരിച്ച് ഹരണഫലത്തിൽ ദശാംശബിന്ദു ഇടുക.

ഉദാ : $\frac{0.9}{0.15} = \frac{0.9 \times 100}{0.15 \times 100} = \frac{90}{15} = 6$

Note:

(i)
$3.456 \times 10 = 34.56, \quad 3.456 \div 10 = 0.3456$
$3.456 \times 100 = 345.6, \quad 3.456 \div 100 = 0.03456$
$3.456 \times 1000 = 3456, \quad 3.456 \div 1000 = 0.003456$

(ii)	12×12	=	144	$12 \div 12$	=	1
	12×1.2	=	14.4	$12 \div 1.2$	=	10
	1.2×1.2	=	1.44	$12 \div 0.12$	=	100
	0.12×1.2	=	0.144	$12 \div 0.012$	=	1000
	0.12×0.12	=	0.0144	$12 \div 0.0012$	=	10000

ക്രോഡീകരണം

- 10ന്റെ കൃതികൾ ഛേദമായി വരുന്ന ഭിന്നസംഖ്യകളാണ് ദശാംശസംഖ്യകൾ അഥവാ ദശാംശഭിന്നങ്ങൾ.
- എല്ലാ ദശാംശസംഖ്യകളെയും ഭിന്നസംഖ്യകളായും, എല്ലാ ഭിന്നസംഖ്യകളെയും ദശാംശസംഖ്യകളായും മാറ്റിയെഴുതാൻ കഴിയും.
- ദശാംശസംഖ്യകൾ തമ്മിൽ കൂട്ടുന്നതിന്, അവയുടെ ദശാംശസ്ഥാനങ്ങളുടെ എണ്ണം തുല്യമായിരിക്കണം. തുല്യമല്ലെങ്കിൽ പൂജ്യം ചേർത്ത് തുല്യമാക്കണം.
- ദശാംശസംഖ്യകൾ തമ്മിൽ ഗുണിക്കുന്നതിന്, സംഖ്യകളെ മാത്രം ഗുണിച്ച്, മൊത്തം ദശാംശസ്ഥാനങ്ങളുടെ എണ്ണം ഗുണനഫലത്തിൽ ഇടത്തോട്ട് മാറ്റി ദശാംശബിന്ദു ഇട്ടാൽ മതി.
- ഒരു ദശാംശസംഖ്യയെ മറ്റൊരു ദശാംശസംഖ്യകൊണ്ട് ഹരിക്കുമ്പോൾ ഹാരകം എപ്പോഴും ഒരു പൂർണ്ണസംഖ്യയായിരിക്കണം.

തുടർപ്രവർത്തനങ്ങൾ

1. 0.006ന് തുല്യമായ ഭിന്നസംഖ്യ ഏത്?
2. $\frac{1}{2}$ ന് തുല്യമായ ദശാംശസംഖ്യ എഴുതുക.
3. 28.09നോട് എത്ര കൂട്ടിയാൽ 50 കിട്ടും ?
4. 45 സെന്റീമീറ്റർ എത്ര മീറ്ററാണ് ?
5. 455 മില്ലീമീറ്റർ എത്ര ലിറ്റർ ?

Reference

1. Text Book of Std. VI SCERT (2015)
2. Teacher Text of Std. VI SCERT (2012)

മൊഡ്യൂൾ - 4

അംശബന്ധം - അനുപാതം

❑ ആമുഖം

ഭിന്നസംഖ്യയുടെ മറ്റൊരു ചിത്രീകരണമാണ് അംശബന്ധം. രണ്ടിൽ കൂടുതൽ അളവുകളുടെ താരതമ്യം പറയുന്നിടത്താണ് അംശബന്ധം ഉപയോഗിക്കുന്നതിന്റെ സൗകര്യം വ്യക്തമാകുന്നത്. നിത്യജീവിതത്തിൽ പലപ്പോഴും അംശബന്ധത്തിന്റെയും അനുപാതത്തിന്റെയും പ്രയോഗങ്ങൾ ഉണ്ടാവാറുണ്ട്.

❑ ലക്ഷ്യങ്ങൾ

1. അംശബന്ധത്തിന്റെയും അനുപാതത്തിന്റെയും അടിസ്ഥാന ആശയങ്ങളെക്കുറിച്ച് ധാരണ നേടുന്നതിന്.
2. അംശബന്ധത്തിന്റെയും അനുപാതത്തിന്റെയും പ്രായോഗിക പ്രശ്നങ്ങൾ പരിഹരിക്കുന്നതിനുള്ള ശേഷി നേടുന്നതിന്.

❑ അടിസ്ഥാനാശയങ്ങൾ

1. അംശബന്ധം

അളവുകൾ തമ്മിൽ താരതമ്യം ചെയ്യുമ്പോഴാണ് ഈ ആശയം ഉപയോഗിക്കുന്നത്.

ഉദാഹരണം : ഒരു ത്രികോണത്തിൽ

- ഏറ്റവും വലിയ വശം, ഏറ്റവും ചെറിയ വശത്തിന്റെ $1\frac{1}{2}$ മടങ്ങ്.
- ഇടത്തരം വശം, ഏറ്റവും ചെറിയ വശത്തിന്റെ $1\frac{1}{2}$ മടങ്ങ് എന്ന് രണ്ടായിപ്പറയുന്നതിന് പകരം ഏറ്റവും ചെറിയ വശത്തിന്റെ $\frac{1}{4}$ ഭാഗം യൂണിറ്റായെടുത്ത്.

ത്രികോണത്തിലെ വശങ്ങളുടെ നീളം 4:5:6 എന്ന അംശബന്ധത്തിലാണ് എന്ന് പറയാം.

മറ്റ് ഉദാഹരണങ്ങൾ

- സിമന്റും മണലും 1:3 എന്ന അംശബന്ധത്തിൽ ചേർത്ത് ചാന്ത് ഉണ്ടാക്കാറുണ്ട്. ഒരു ചട്ടി സിമന്റിന് 3 ചട്ടി മണൽ ചേർക്കണം എന്നാണിതിനർത്ഥം.
- സ്കൂൾ ക്ലാസ്സുകളിലെ അധ്യാപകരും കുട്ടികളും തമ്മിലുള്ള അംശബന്ധം 1:30 ആണ്. അംശബന്ധത്തിലെ പദങ്ങൾ തിരിച്ചെഴുതിയാൽ ആശയവും തിരിഞ്ഞുപോകും.

അംശബന്ധ ലഘൂകരണം

ഒരു അംശബന്ധത്തിലെ 2 പദങ്ങളെയും ഒരു നിശ്ചിത സംഖ്യകൊണ്ട് ഹരിച്ചാൽ ആ അംശബന്ധം ലളിതമാകും. ഉദാഹരണത്തിന്, 40:25 എന്ന അംശബന്ധം ലളിതമാക്കാൻ രണ്ട് പദങ്ങളെയും 5 കൊണ്ട് ഹരിച്ചാൽ മതി.

അതായത്; 40:25 = 8:5

അതുപോലെ, ഒരു അംശബന്ധത്തിലെ പദങ്ങളെ ഒരു നിശ്ചിതസംഖ്യകൊണ്ട് ഗുണിച്ചാൽ അത് വികസിക്കുകയും ചെയ്യും.

ഉദാ : 2:5 നെ 3 കൊണ്ട് ഗുണിച്ചാൽ 6 : 15

അതായത്, നിശ്ചിത സംഖ്യ x ആണെങ്കിൽ

a:b = a x : b x ആയിരിക്കും.

2. അനുപാതം

അംശബന്ധങ്ങളെ വികസിപ്പിക്കുമ്പോഴും, ലഘൂകരിക്കുമ്പോഴും കിട്ടുന്ന പുതിയ അംശബന്ധങ്ങൾ പഴയതിന് സമാനമായിട്ടാണ് നിലനിൽക്കുന്നത്. ഇപ്രകാരത്തിൽ 2 അംശബന്ധങ്ങളുടെ തുല്യതയെ അനുപാതം എന്നുപറയുന്നു. അതായത്, a : b = c : d ആയാൽ a:bയും c:d യും അനുപാതത്തിൽ ആണ് എന്നുപറയുന്നു.

- 2 അംശബന്ധങ്ങൾ അനുപാതത്തിലായാൽ അവയുടെ അന്ത്യപദങ്ങളുടെ ഗുണനഫലവും, മധ്യപദങ്ങളുടെ ഗുണനഫലവും തുല്യമായിരിക്കും.

അതായത് ഇവിടെ, അനുപാതം a : b = c : d ആണെങ്കിൽ

$\boxed{a \times d = b \times c}$ ആയിരിക്കും.

$$d = \frac{bc}{a}, \qquad b = \frac{ad}{c}$$

കൂടാതെ,

$$a = \frac{bc}{d}, \qquad c = \frac{ad}{b}$$

ഉദാ : 2 : 5 = x :20 ആയാൽ x ന്റെ വില എത്ര ?

$$x = \frac{2 \times 20}{5}, \quad \frac{40}{5} = 8$$

സമാനുപാതം

2 സെന്റ് അളവുകൾ മാറുന്നത് ഒരേ രീതിയിലാണെങ്കിൽ ആ മാറ്റം സമാനുപാതത്തിലാണെന്ന് പറയുന്നു.

ഉദാ : ചുവടെയുള്ള ടേബിൾ, പുസ്തകത്തിന്റെ എണ്ണവും വിലയും തന്നിരിക്കുന്നു.

പുസ്തകത്തിന്റെ എണ്ണം	1	2	3	4	5	6	7
പുസ്തകത്തിന്റെ വില	6	12	18	24	30	36	42

ഇവിടെ

$$\frac{1}{6} = \frac{2}{12} = \frac{3}{18} = \frac{4}{24} = \underline{\qquad\qquad}$$ സമാനുപാതത്തിലാണ്.

വിപരീതാനുപാതം

എന്നാൽ ചില മാറ്റങ്ങൾ വിപരീതമായിരിക്കും. ആ മാറ്റത്തെ വിപരീതാനുപാതം എന്നു പറയുന്നു.

ഉദാഹരണം : ഒരു കാർ 300 കി.മീ. വേഗതയിൽ സഞ്ചരിച്ച സമയം

വേഗത	60 km	50 km	30 km	20 km	10 km
സമയം	5 hrs.	6 hrs.	10 hrs.	15 hrs.	30 hrs.

മേൽ കൊടുത്ത ടേബിളിൽ നിന്നും വ്യക്തമാകുന്ന ഒരു വസ്തുത, വേഗത കൂടുന്നതിന നുസരിച്ച് സമയം കുറയുന്നു. ഈ മാറ്റം വിപരീതാനുപാതമാണ്.

ഇവിടെ വേഗതയെ x_1, x_2, x_3.... എന്നും സമയത്തെ y_1, y_2, y_3..... എന്നും കരുതിയാൽ

$$\frac{x_1}{x_2} = \frac{y_1}{y_2} \quad \text{ആണ്}$$

ഉദാ : 8 പേർ 24 ദിവസംകൊണ്ട് ചെയ്യുന്ന ഒരു ജോലി 6 പേർ എത്ര ദിവസംകൊണ്ട് ചെയ്യും?

വിശകലനം

ഇവിടെ ആളുകളുടെ എണ്ണത്തെ x അളവുകൾ ആയും ദിവസങ്ങളുടെ എണ്ണത്തെ y അളവുകളുമായും എടുത്താൽ

$$x_1 = 8, \quad x_2 = 6, \quad y_1 = 24, \quad y_2 = ?$$

$$\frac{x_1}{x_2} = \frac{y_2}{y_1} = \frac{8}{6} = \frac{y_2}{24} = y_2 = \frac{24 \times 8}{6} = 32$$

$\therefore$ 6 ആർക്ക് 32 ദിവസം വേണം ജോലി തീർക്കാൻ.

ഒരു നിശ്ചിത സംഖ്യയെ നിശ്ചിത അംശബന്ധത്തിൽ വിഭജിക്കുന്ന വിധം

x എന്ന സംഖ്യയെ a:b:c യിൽ വിഭജിക്കുന്ന വിധം

- ആദ്യം അംശബന്ധത്തിലെ 3 പദങ്ങളും തമ്മിൽ കൂട്ടിയെഴുതണം.

$$= (a + b + c)$$

$$\therefore \text{ആദ്യഭാഗം} = x \times \frac{a}{(a + b + c)}$$

$$\text{രണ്ടാംഭാഗം} = x \times \frac{b}{(a + b + c)}$$

$$\text{മൂന്നാംഭാഗം} = x \times \frac{c}{(a + b + c)}$$

ഉദാഹരണം : 800 രൂപയെ രാമനും ഗോപിക്കും 2:3 എന്ന അംശബന്ധത്തിൽ വിഭജിക്കുക.

വിശകലനം

അംശബന്ധത്തിലെ പദങ്ങളുടെ തുക = $2 + 3 = 5$

രാമന്റെ വിഹിതം = $\frac{2}{5} \times 800 = 320$

ഗോപിയുടെ വിഹിതം = $\frac{3}{5} \times 800 = 480$

- ICT Slot → Ubuntu → School Resources → അംശബന്ധവും അനുപാതവും

ക്രോഡീകരണം

- a യും b യും തമ്മിലുള്ള അംശബന്ധത്തെ a : 6 എന്ന് സൂചിപ്പിക്കുന്നു.
- a:b യും c:d യും തുല്യ അനുപാതത്തിലായാൽ അവയെ a:b = c:d എന്ന് സൂചിപ്പിക്കാം.
- a:b = c:d ആണെങ്കിൽ $\frac{a}{b} = \frac{c}{d}$ ആയിരിക്കും. അതായത് ad = bc ആയിരിക്കും
- ഒരു അംശബന്ധത്തിലെ സംഖ്യകളെ മറ്റൊരു സംഖ്യകൊണ്ട് ഗുണിക്കുകയോ, ഹരിക്കുകയോ ചെയ്താൽ തുല്യ അനുപാതത്തിലുള്ള അംശബന്ധങ്ങൾ ലഭിക്കും.

തുടർപ്രവർത്തനങ്ങൾ

1. 8 : x = 16 : 10 ആയാൽ x ന്റെ വില എത്ര ?
2. $\frac{1}{5} : \frac{1}{3}$ ന് തുല്യമായ അംശബന്ധമെന്ത് ?
3. 3 പേരുടെ വയസ്സുകൾ 2:3:4 എന്ന അംശബന്ധത്തിലാണ്. അവരുടെ വയസ്സുകളുടെ തുക 54. എങ്കിൽ മൂത്തയാളിന്റെ വയസ്സ് എത്ര ?
4. 3500 എന്ന സംഖ്യയെ 4:3 എന്ന അംശബന്ധത്തിൽ വിഭജിക്കുക.

Reference

1. Text Book of Std. VII - SCERT (2014)
2. Teacher Text of Std. VII - SCERT (2014)

മൊഡ്യൂൾ - 5

ജ്യാമിതി

❑ ആമുഖം

പുരാതന മനുഷ്യന് സംഖ്യാബോധത്തോടൊപ്പംതന്നെ പ്രകൃതിയിലെ പലതരം കേവ ലരൂപങ്ങളെക്കുറിച്ചും ധാരണയുണ്ടായിരുന്നു. വളവില്ലാതെയൊഴുകുന്ന പുഴകളിലും, നേരെ വളരുന്ന മരങ്ങളിലും രേഖയെയും, ആകാശഗോളങ്ങളിലും മറ്റും വൃത്തത്തെയും, അകലെയുള്ള മലനിരകളിൽ ത്രികോണത്തെയും കാണാൻ മനുഷ്യന് കഴിഞ്ഞു. പ്രായോഗിക ജീവിതത്തിൽ, കൃഷിസ്ഥലത്തിന് വേലികെട്ടുമ്പോഴും അളവുകൾ ആവശ്യമായി വന്നു. അപ്രകാരം ഈ രൂപ ങ്ങൾ സംഖ്യകളുമായി ബന്ധപ്പെട്ടാണ് ജ്യാമിതി എന്ന ഗണിതശാസ്ത്രശാഖ ഉണ്ടായത്.

നീളം, പരപ്പളവ്, വ്യാപ്തം തുടങ്ങിയവ അളക്കാനുള്ള പ്രായോഗിക മാർഗ്ഗങ്ങൾ കണ്ടെ ത്തുക എന്ന ആവശ്യത്തിൽ നിന്നാണ് ജ്യാമിതിയുടെ ഉത്ഭവം. ത്രികോണം, ചതുരം, വൃത്തം തുടങ്ങിയ സംവൃതരൂപങ്ങളുടെ ചുറ്റളവുകളും പരപ്പളവുകളും കണ്ടെത്തുന്നതിലേക്കും അവ യുമായി ബന്ധപ്പെട്ട പ്രധാന ഗണിതതത്വങ്ങൾ രൂപീകരിക്കുന്നതിനും പിന്നീട് ശ്രമങ്ങൾ ഉണ്ടായി.

ജ്യാമിതിയുടെ അടിസ്ഥാനാശയങ്ങളെക്കുറിച്ചും അവയുടെ പ്രായോഗിക സന്ദർഭങ്ങളെ ക്കുറിച്ചുമാണ് ഈ മൊഡ്യൂളിൽ വിശദീകരിക്കുന്നത്.

❑ ഉദ്ദേശ്യങ്ങൾ

1. ജ്യാമിതിയുടെ അടിസ്ഥാനാശയങ്ങളെക്കുറിച്ചുള്ള ധാരണ വികസിപ്പിക്കുന്നതിന്.
2. നൂതനസന്ദർഭങ്ങളിൽ ജ്യാമിതിയുടെ ആശയങ്ങൾ പ്രയോഗിക്കുന്നതിനുള്ള ശേഷി നേടുന്നതിന്.

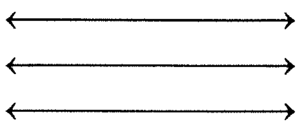
(i) ജ്യാമിതിയും അളവും

ഒരു നീണ്ട ചരട് അല്ലെങ്കിൽ ഒരു റിബ്ബൺ, ഇവിടെ നീളത്തിന്റെ അളവിന് മാത്രമാ ണല്ലോ പ്രസക്തിയുള്ളത്. ഇങ്ങനെ നീളം മാത്രം പ്രസക്തമായവയെ ഏകമാനത്തിലുള്ളവ എന്ന് പറയുന്നു.

എന്നാൽ, ഒരു പേപ്പർഷീറ്റിന് നീളം മാത്രമല്ല, വീതിയും പരിഗണിക്കണമല്ലോ. ഇവ ചേർന്ന ഒരു തലമാണ് അതിനുള്ളത്. ഇപ്രകാരം നീളവും വീതിയും പരിഗണിക്കേണ്ടവയെ വിമാനത്തിലുള്ളത് എന്ന് പറയാം.

ഇനി, ഒരു ചതുരപ്പെട്ടി സങ്കൽപ്പിക്കൂ. അതിന് നീളവും വീതിയും, മാത്രമല്ല, പൊക്കവും ഉണ്ടല്ലോ. ഇപ്രകാരം 3 അളവുകൾ പരിഗണിക്കേണ്ടവയെ ത്രിമാനതലത്തിലുള്ളവ എന്ന് പറ യുന്നു.

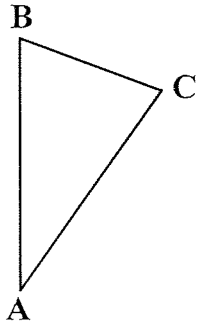
(ii) രേഖകൾ



ഏറ്റവും ലളിതമായ ജ്യാമിതീയ രൂപമാണ് നേർവര. നാം വരയ്ക്കുന്ന ഏത് നേർരേഖയ്ക്കും ക്ലിപ്തമായ നീളം ഉണ്ടായിരിക്കും. എന്നാൽ ആവശ്യത്തിനനുസരിച്ച്, ഈ വര എത്ര വേണമെങ്കിലും നീട്ടാൻ കഴിയും. ഇങ്ങനെ, അനന്തമായി നീട്ടാൻ സാധിക്കുന്ന ഒരു നേർവരയെയാണ് ജ്യാമിതിയിൽ രേഖ എന്ന് വിളിക്കുന്നത്. പ്രായോഗിക ആവശ്യങ്ങൾക്ക് ഒരു രേഖയുടെ കൃത്യമായ അളവിലുള്ള കഷണങ്ങളായിരിക്കും വേണ്ടിവരിക. ഇത്തരം കഷണങ്ങളെ രേഖാഖണ്ഡം എന്ന് പറയുന്നു.

(iii) തലങ്ങൾ

3 ബിന്ദുക്കൾ ഒരു പ്രത്യേക ഉപരിതലത്തിൽ ഉൾക്കൊള്ളുന്ന തരത്തിൽ രൂപപ്പെടുമ്പോൾ ഉണ്ടാവുന്നതാണ് തലങ്ങൾ. ഒരു സമതലത്തിലെ രണ്ട് ബിന്ദുക്കളെ തമ്മിൽ ബന്ധിപ്പിക്കുന്ന പലതരം പാതകളിൽ ഏറ്റവും നീളം കുറഞ്ഞ് അവയെ യോജിപ്പിക്കുന്ന രേഖാഖണ്ഡമാണ്. ഇതിൽനിന്ന് നമുക്ക് മറ്റൊരു കാര്യം കണ്ടെത്താം.



ചിത്രത്തിൽ A, B എന്നീ 2 ബിന്ദുക്കളെ യോജിപ്പിക്കുന്ന ഏറ്റവും നീളംകുറഞ്ഞ രേഖ ABയാണ്. AC, CB എന്നീ രേഖാഖണ്ഡങ്ങൾ ചേർത്ത് വെച്ചാൽ, അയിൽനിന്ന് ആയിലേക്കുള്ള മറ്റൊരു പാതയായി. അപ്പോൾ $AC + BC > AB$ എന്ന് ലഭിക്കുന്നു.

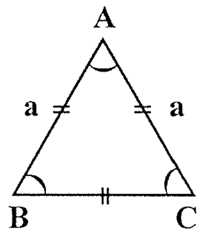
മറ്റു ബിന്ദുക്കൾ ഉപയോഗിച്ച് ഇതേ പ്രത്യേകത ആവർത്തിച്ചാൽ, ഒരു ത്രികോണത്തിന്റെ ഏത് 2 വശങ്ങളുടെയും തുക മൂന്നാമത്തെ വശത്തേക്കാൾ വലുതായിരിക്കും.

വിവിധ തലങ്ങൾ

1. ത്രികോണം

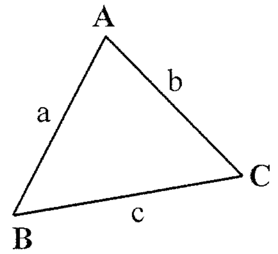
3 വശങ്ങളുള്ള ഒരു ഒരു അടഞ്ഞ രൂപമാണ് ത്രികോണം.

(1) സമഭുജത്രികോണം



- ഒരു ത്രികോണത്തിന്റെ 3 വശങ്ങളും തുല്യ നീളമുള്ളവയാണ്. അത് സമഭുജത്രി കോണമാണ്.
- ഒരു സമഭുജത്രികോണത്തിലെ എല്ലാ കോണുകളും 60^0 ആണ്.
- ഒരു സമഭുജത്രികോണത്തിലെ ചുറ്റളവ് = 3a
- ഒരു സമഭുജത്രികോണത്തിലെ പരപ്പളവ് = $\frac{\sqrt{3}}{4} a^2$

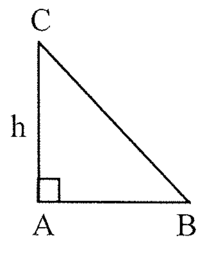
(2) വിഷമഭുജത്രികോണം

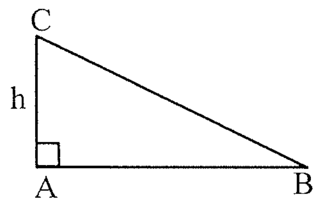


- ഒരു ത്രികോണത്തിന്റെ 3 വശങ്ങളുടെയും നീളങ്ങൾ വ്യത്യസ്ത അളവുകളാണെങ്കിൽ അത്തരം ത്രികോണമാണ് വിഷമഭുജത്രികോണം.
- വിഷമഭുജ ത്രികോണത്തിന്റെ ചുറ്റളവ് = a + b + c (3 വശങ്ങളുടെയും തുക)
- വിഷമഭുജ ത്രികോണത്തിന്റെ പരപ്പളവ് = $\sqrt{s(s-a)(s-b)(s-c)}$

$$s = \frac{a+b+c}{2}$$

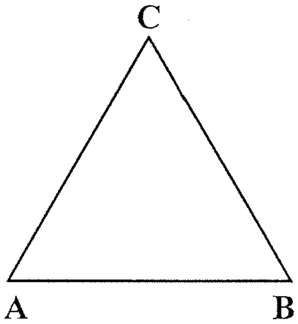
(3) മട്ടത്രികോണം





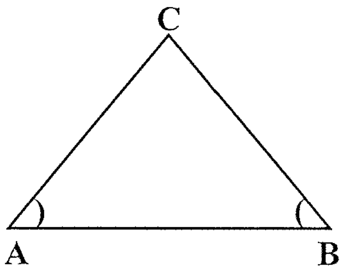
- ഒരു ത്രികോണത്തിലെ ഏതെങ്കിലും ഒരു കോണിന്റെ ഡിഗ്രി അളവ് 90^0 ആണെങ്കിൽ അത് ഒരു മട്ടത്രികോണമാണ്.
- മട്ടത്രികോണത്തിന്റെ പാദം b യും, അതിലേക്കുള്ള ലംബം h ഉം ആയാൽ പരപ്പളവ് $= \frac{1}{2}$ bh sq. unit ആണ്.

(4) **സമപാർശ്വ ത്രികോണം**



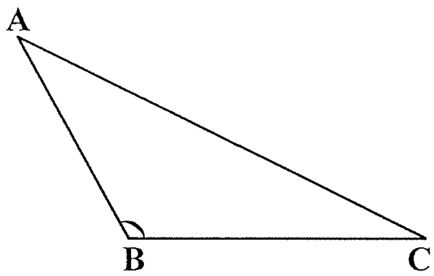
- ഒരു ത്രികോണത്തിലെ ഏതെങ്കിലും 2 വശങ്ങളുടെ നീളങ്ങൾ തുല്യമായാൽ അതൊരു സമപാർശ്വത്രികോണമാണ്.
- ഒരു സമപാർശ്വത്രികോണത്തിന്റെ പാദകോണുകൾ തുല്യമായിരിക്കും.

(5) **ന്യൂനത്രികോണം**



- ഒരു ത്രികോണത്തിലെ എല്ലാ കോണുകളും ന്യൂനകോണുകളായാൽ അത്തരം ത്രികോണങ്ങളാണ് ന്യൂനത്രികോണങ്ങൾ.

(6) **ബൃഹത്ത്രികോണം**



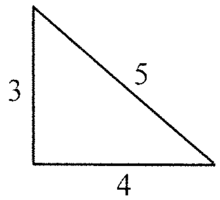
- ഒരു ത്രികോണത്തിലെ ഏതെങ്കിലും ഒരു കോൺ ബൃഹത്കോൺ ($>90^0$) ആണെങ്കിൽ അത്തരം ത്രികോണങ്ങളാണ് ബൃഹത് ത്രികോണങ്ങൾ.

മറ്റു പ്രത്യേകതകൾ

1. ഒരു ത്രികോണത്തിലെ എല്ലാ കോണുകളുടെയും അളവുകളുടെ തുക 180^0 ആണ്.
2. ഒരു മട്ടത്രികോണത്തിന്റെ പാദം, b യും, ലംബം a യും കർണ്ണം c യും ആണെങ്കിൽ $c^2 = a^2 + b^2$ ആയിരിക്കും. ഇതാണ് പൈതഗോറസ് സിദ്ധാന്തം.

   അതായത് കർണ്ണം^{2} = പാദം^{2} + ലംബം^{2}

3. ഒരു ത്രികോണത്തിലെ വലിയ വശത്തിന്റെ അളവ്, ബാക്കി 2 വശങ്ങളുടെ അളവിനേക്കാൾ കുറവായിരിക്കും.



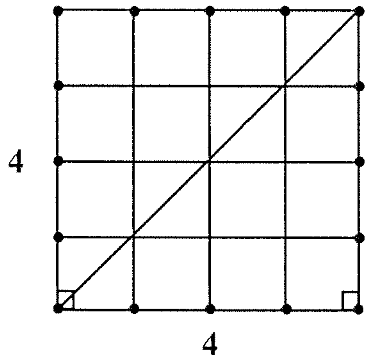
$3^2 + 4^2 = 5^2$

പൈതഗോറസ് സിദ്ധാന്തം

2. ചതുർഭുജങ്ങൾ

4 വശങ്ങളുള്ള തലമാണ് ചതുർഭുജം. വിവിധ ചതുർഭുജങ്ങൾ താഴെ കൊടുക്കുന്നു.

(1) സമചതുരം



- ഒരു ചതുർഭുജത്തിലെ എല്ലാ വശങ്ങളും തുല്യവും എല്ലാ കോണുകളും 90^0 ആയാൽ അതാണ് സമചതുരം.
- സമചതുരത്തിന്റെ ചുറ്റളവ് : (വശം a യൂണിറ്റായാൽ) = 4a
- സമചതുരത്തിന്റെ പരപ്പളവ്

  1 യൂണിറ്റ് പരപ്പളവുള്ള എല്ലാ സമചതുരങ്ങളുടെയും തുക = വശം × വശം

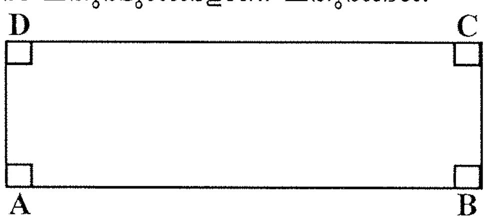
  വശം 'a' യൂണിറ്റായാൽ = a^2 ച.സെ.മീ. പൈതഗോറസ് സിദ്ധാന്തം

  വികർണ്ണം വശം a ആയാൽ = $a\sqrt{2}$

$$\left[\begin{aligned} d &= \sqrt{a^3 + a^2} \\ &= \sqrt{2a^2} \\ &= \sqrt{2}\ a \end{aligned}\right]$$

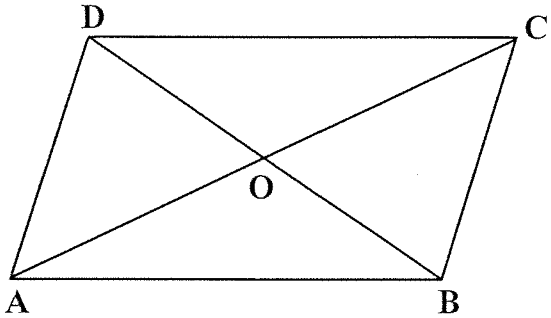
(2) ചതുരം

- ഒരു ചതുർഭുജത്തിന്റെ എതിർവശങ്ങൾ തുല്യവും എല്ലാ കോണുകളും 90^0 യും ആയാൽ അത്തരം ചതുർഭുജങ്ങളാണ് ചതുരങ്ങൾ.



- ചതുരത്തിന്റെ ചുറ്റളവ് 2 (നീളം + വീതി)
- ചതുരത്തിന്റെ പരപ്പളവ് = നീളം × വീതി
- ചതുരത്തിന്റെ നീളവും വീതിയും തുല്യമാണെങ്കിൽ അത് ഒരു സമചതുരമായിരിക്കും.

(3) സാമാന്തരികം

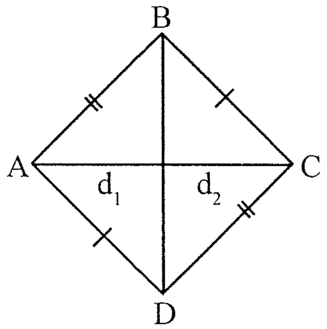


- ഒരു ചതുർഭുജത്തിന്റെ എതിർവശങ്ങൾ തുല്യവും 2 ജോടി വശങ്ങൾ സമാന്തരമാവുകയും ചെയ്താൽ അത്തരം ചതുർഭുജങ്ങളാണ് സാമാന്തരികങ്ങൾ.
- ഒരു സമാന്തരികത്തിന്റെ വികർണ്ണങ്ങൾ പരസ്പര സമഭാഗം ചെയ്യും.
- ഒരു സാമാന്തരികത്തിന്റെ ഏതെങ്കിലും ഒരു വശത്തിന്റെ നീളം b യും ആ വശത്തേക്കുള്ള ഉന്നതി 'h' ഉം ആയാൽ

  ചുറ്റളവ് = 2 (a + b), a, b സമാന്തരങ്ങൾ

  പരപ്പളവ് = bh

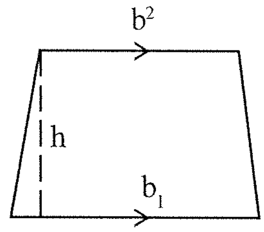
(4) സമഭുജ സാമാന്തരികം



- ഒരു ചതുർഭുജത്തിലെ എല്ലാ വശങ്ങളും തുല്യവും, 2 ജോടി വശങ്ങൾ സമാന്തരവും, എതിർകോണുകൾ തുല്യവുമാണെങ്കിൽ അവയാണ് സമഭുജസാമാന്തരികം.
- എല്ലാ വശങ്ങളും തുല്യമായ സമഭുജസാമാന്തരികത്തിന്റെ ചുറ്റളവ് = 4 × ഒരുവശം
- പരപ്പളവ് = bh or ½ [$d_1 \times d_2$]

  d_1 d_2 എന്നിവ വികർണ്ണങ്ങൾ

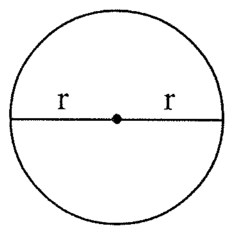
(5) ലംബകം



- ഒരു ചതുർഭുജത്തിന്റെ ഒരു ജോടി എതിർവശങ്ങൾ സമാന്തരങ്ങളായാൽ അതാണ് ലംബകം.
- ലംബകത്തിന്റെ സമാന്തരവശങ്ങൾ യഥാക്രമം b_1, b_2 എന്നിവയും അവ തമ്മിലുള്ള അകലം h ഉം ആയാൽ

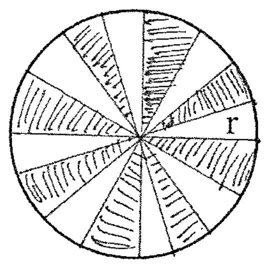
  ലംബകത്തിന്റെ വിസ്തീർണ്ണം = ½ $(b_1, b_2)h$ ആയിരിക്കും.

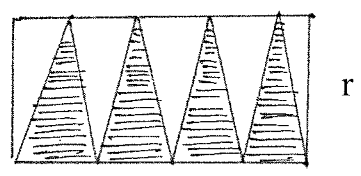
(6) വൃത്തങ്ങൾ



(ചിത്രം - 1)

- ഒരു നിശ്ചിത ബിന്ദുവിൽനിന്നും ഒരു നിശ്ചിത അകലത്തിൽ സ്ഥിതിചെയ്യുന്ന എല്ലാ ബിന്ദുക്കളുടെയും പഥമാണ് വൃത്തം.
- നിശ്ചിത ബിന്ദുവിനെ വൃത്തകേന്ദ്രം എന്നും, നിശ്ചിത അകലത്തെ ആരം (r) എന്നു പറയുന്നു.





(ചിത്രം - 2)

- ഒരു വൃത്തത്തിന്റെ ആരം 'r' ആണെങ്കിൽ വ്യാസം = 2r ആണ്.
- വൃത്തത്തിന്റെ ചുറ്റളവിനെ വ്യാസംകൊണ്ട് ഹരിച്ചാൽ ലഭിക്കുന്ന സംഖ്യയാണ് π.
- അതായത് വൃത്തത്തിന്റെ ചുറ്റളവ് = $\pi \times$ വ്യാസം ആണ്.
- വൃത്തത്തിന്റെ ചുറ്റളവ് = $\pi \times 2r = 2\pi r$ ആണ്.
- ഒരേ ചുറ്റളവുള്ള രൂപങ്ങളിൽ ഏറ്റവും കൂടിയ പരപ്പളവ് വൃത്തത്തിനാണ്.
- ഒരു വൃത്തത്തിന്റെ ആരം X ഇരട്ടിയായാൽ പരപ്പളവ് X^2 ഇരട്ടിയാകും.
- ഒരു വൃത്തത്തിന്റെ ആരം X ഇരട്ടിയായാൽ ചുറ്റളവ് X ഇരട്ടിയാകും.

- ബഹുഭുജങ്ങളും വശങ്ങളുടെ എണ്ണം കൂടുംതോറും അതിന്റെ പരപ്പളവ് വൃത്തത്തിന്റെ പരപ്പളവിനോട് കൂടുതൽ അടുക്കുന്നു.
- മുകളിൽ കൊടുത്ത ചിത്രം 2ൽ ഒരു വൃത്തത്തെ ത്രികോണങ്ങളാക്കി ഭാഗിച്ചിരിക്കുന്നു. ഇവയെ മുറിച്ചെടുത്ത് അടുക്കിവെച്ചാൽ ഒരു ദീർഘചതുരംപോലെയുള്ള രൂപം കിട്ടും. വൃത്തത്തെ കൂടുതൽ ത്രികോണങ്ങളാക്കി ഭാഗിച്ചാൽ കുറച്ചുകൂടി ശരിയായ ഒരു ചതുരം കിട്ടും. ഇപ്രകാരം വൃത്തത്തിന്റെ പരിധിമുഴുവൻ ചതുരത്തിന്റെ നീളം കൂടിയ 2 വശങ്ങളിലായി ഉപയോഗിച്ചിട്ടുണ്ട്.

  വൃത്തത്തിന്റെ ആരം 'r' ആയാൽ ഈ പരിധിയുടെ നീളം, വൃത്തത്തിന്റെ ചുറ്റളവായ $2\pi r$ ആണ്. അതുകൊണ്ട് ചതുരത്തിന്റെ ഒരു വശത്തിന്റെ നീളം

  $$= \frac{1}{2} \times 2\pi r = \pi r$$ ആയിരിക്കും.

  മറ്റേ വശത്തിന്റെ നീളം = r ആയതിനാൽ

  ചതുരാകൃതിയുടെ വിസ്തീർണ്ണം = $\pi r \times r = \pi r^2$ ആണ്

പ്രയോഗങ്ങൾ

- കിണർ കുഴിക്കുന്ന ആകൃതി, വള, പപ്പടം ഇവയുടെ ആകൃതി (കൂടുതൽ പരപ്പളവ് എടുക്കുന്നു).
- മൺപാത്ര നിർമ്മാണം (തിരിയുന്ന ചക്രമുപയോഗിച്ച്).
- മനുഷ്യപുരോഗതിയുടെ ഒരു പ്രധാന സംഭവമാണ് ചക്രങ്ങളുടെ കണ്ടെത്തൽ.

ICT Slots : Geogebra Appletts - Circles

തുടർപ്രവർത്തനങ്ങൾ

1. 60 cm ചുറ്റളവുള്ള ഒരു ചതുരത്തിന്റെ വീതി 12 cm ആണെങ്കിൽ നീളം എത്ര ?
2. 4 cm വികർണ്ണമുള്ള ഒരു സമചതുരത്തിന്റെ പരപ്പളവ് എത്ര ?
3. വൃത്താകൃതിയിലുള്ള 88 cm നീളമുള്ള കയറിനകത്തെ പരപ്പളവ് എത്ര ?
4. മട്ടത്രികോണത്തിന്റെ കർണ്ണം = 15 cm, ലംബം = 9 cm എങ്കിൽ പാദം എത്ര ?
5. ഒരു ത്രികോണത്തിന്റെ വശങ്ങൾ യഥാക്രമം 6 cm, 8 cm, 10 cm എങ്കിൽ പ്രസ്തുത ത്രികോണത്തിന്റെ ചുറ്റളവും പരപ്പളവും കണ്ടുപിടിക്കുക.

Reference

1. Text Books of Std. V, VI, VII, SCERT (2013)
2. Teacher Text of Std. V, VI, VII, SCERT (2013)
3. ICT Resource - Application - School Resources - Std. VI
4. ICT - Ubuntu - Application - Resources - PhET Applets.

മൊഡ്യൂൾ - 6

ബീജഗണിതം

❑ ആമുഖം

സംഖ്യകളെക്കുറിച്ചും അവയുടെ പരസ്പരബന്ധത്തെക്കുറിച്ചുമുള്ള അറിവ് വർദ്ധിച്ചതോടെ, ഇവയെ സംബന്ധിച്ച് പൊതുതത്ത്വങ്ങൾ ആവിഷ്ക്കരിക്കപ്പെട്ടു. ഈ തത്വങ്ങളെ അർത്ഥശങ്കക്കിടയില്ലാത്ത വിധം സംക്ഷിപ്തമായി അവതരിപ്പിക്കേണ്ടതും ആവശ്യമായി.

ഭൗതികപ്രശ്നങ്ങളെ ഗണിതത്തിന്റെ ഭാഷയിലാക്കുന്നതിനും അപഗ്രഥിക്കാനും, ഉത്തരം കണ്ടെത്താനും ഇത്തരം ചുരുക്കെഴുത്ത് ആവശ്യമായി വന്നു. പൊതുതത്വങ്ങൾ സാമാന്യവൽക്കരിക്കുമ്പോഴും ഇത്തരം ചുരുക്കെഴുത്ത് അഥവാ ബീജഗണിതം (Algebra) ഉപയോഗിക്കുന്നു.

പ്രശസ്ത കവിയായ ഒമർഖയ്യാമിന്റെ വാചകത്തിൽ, 'അറിയാത്തത് കണ്ടുപിടിക്കുക എന്നത് ലക്ഷ്യമാക്കിയുള്ള ഒരു പ്രവർത്തനപദ്ധതിയാണ് ബീജഗണിതം' എന്ന് വിശദമാക്കുന്നു.

ചരം (Variable)

അങ്കഗണിതത്തിലെ സംഖ്യകൾക്ക് പകരം ആയി ബീജഗണിതത്തിലുപയോഗിക്കുന്ന അക്ഷരങ്ങളും ചിഹ്നങ്ങളുമാണ് ചരം എന്നറിയപ്പെടുന്നത്. ഇവയുടെ വില അനിശ്ചിതമാണ്.

eg: x, y, α, β etc.

വാചകം

അപൂർണ്ണമായ ആശയത്തെ പ്രതിനിധീകരിക്കുന്നതാണ് വാചകം.

1. ഉദാ: (i) സംഖ്യകളുടെ തുക

   (ii) ഒരു സംഖ്യയുടെ 3 മടങ്ങ്

ചില ഉദാഹരണങ്ങൾ എടുക്കാം

2. $5 + 4, 8 - 7, 6 + 4 - 1$
3. $x + y + 5, \; a + b + 8, \; p + q + \Upsilon$

മുകളിൽ പറഞ്ഞവയെല്ലാം അപൂർണ്ണ ആശയങ്ങൾ നൽകുന്നവയാണ്. ഈ വാചകങ്ങളെ 3 വിഭാഗങ്ങളാക്കി തിരിക്കാം. ആദ്യത്തെ 3 ഉദാഹരണങ്ങൾ പൂർണ്ണമായും ഭാഷയിലൂടെ പ്രസ്താവിച്ചിരിക്കുന്നതിനാൽ അവയെ ഭാഷാ വാചകങ്ങൾ എന്നു പറയുന്നു.

രണ്ടാമത് പറഞ്ഞ 3 ഉദാഹരണങ്ങൾ പൂർണ്ണമായും സംഖ്യകൾ മാത്രം ഉൾപ്പെടുത്തി പറഞ്ഞിരിക്കുന്നതിനാൽ അവയെ സംഖ്യാവാചകങ്ങൾ എന്നുപറയുന്നു.

മൂന്നാമതായി പറഞ്ഞ ഉദാഹരണങ്ങൾ ഒന്നോ അതിലധികമോ ചരങ്ങൾ ഉൾപ്പെട്ടിരിക്കുന്നതിനാൽ അവയെ ബീജഗണിത വാചകങ്ങൾ എന്നുപറയുന്നു.

eg: രണ്ട് സംഖ്യകളുടെ തുകയുടെ പകുതി - ഭാഷാ വാചകം

$8 + 4 - 2$ - സംഖ്യാവാചകം

$a + b - 8$ - ബീജഗണിതവാചകം

ഭാഷാവാചകങ്ങളെ ബീജഗണിത വാചകങ്ങളാക്കി മാറ്റുന്ന വിധം

ഭാഷാപരമായി പറയുന്ന ആശയങ്ങൾക്ക് ചരങ്ങൾ നൽകി ബന്ധിപ്പിച്ചാൽ മതി.

ഉദാ: രണ്ട് സംഖ്യകളുടെ തുക

ഇവിടെ രണ്ട് വ്യത്യസ്ത സംഖ്യകൾക്ക് പകരമായി x, y അല്ലെങ്കിൽ a, b എന്നീ ചരങ്ങൾ എടുക്കാം.

അതായത്, രണ്ട് സംഖ്യകളുടെ തുക = $x + y$ or $a + b$

മറ്റു ഉദാഹരണങ്ങൾ

- രണ്ട് സംഖ്യകളുടെ വ്യത്യാസം = $x - y$
- ഒരു സംഖ്യയുടെ 5 മടങ്ങ്, $5x$ (സംഖ്യ = x എന്ന് എഴുതുക)
- രണ്ട് സംഖ്യകളുടെ തുകയുടെ പകുതി = $\frac{x+y}{2}$
- ഒരു സംഖ്യയുടെ പകുതി = $\frac{x}{2}$
- രണ്ടു സംഖ്യകളുടെ തുകയുടെ വർഗ്ഗം = $(a + b)^2$

ഇപ്രകാരം ഏത് ആശയത്തിലും സംഖ്യകൾക്ക് പകരം ചരങ്ങൾ നൽകി ബീജഗണിത രൂപത്തിലാക്കാം.

വിവിധതരം ബീജഗണിത വാചകങ്ങൾ

1. ഏകപദം (Monomial)

ഒരു പദം മാത്രമുള്ള ബീജഗണിത വാചകങ്ങളെ ഏകപദം എന്നുപറയുന്നു.

eg : $3x, 5p, 4a$

2. ദ്വിപദം (Binomial)

രണ്ട് പദങ്ങളുള്ള ബീജഗണിത വാചകങ്ങളാണ് ദ്വിപദങ്ങൾ.

eg : $5x + y,\ 2a + 3b,\ p - 2a$

3. ത്രിപദം (Trinomial)

3 പദങ്ങൾ ഉള്ള ബീജഗണിത വാചകങ്ങളാണ് ട്രൈനോമിയലുകൾ.

eg : $a + b + c,\ 5x - 4y + 2z$

ഈ ബീജഗണിത വാചകങ്ങളെയെല്ലാം കൂടി പൊതുവെ അറിയപ്പെടുന്ന കുടുംബനാമം ആണ് പോളിനോമിയൽ.

- ഒരു പദമുള്ള പോളിനോമിയൽ ആണ് ഏകപദം.
- രണ്ട് പദമുള്ള പോളിനോമിയൽ ആണ് ദ്വിപദം.

ഉദാഹരണങ്ങൾ

ഒരു സംഖ്യയുടെ 4 മടങ്ങിനോട് 7 കൂട്ടിയാൽ 19 കിട്ടും. എങ്കിൽ സംഖ്യ ഏത് ?

ഇവിടെ സംഖ്യയെ x എന്ന് കരുതിയാൽ, $4x + 7 = 19$ എന്ന ബീജഗണിത വാക്യം കിട്ടുന്നു. ഈ സമവാക്യം നിർദ്ധാരണം ചെയ്താൽ x ന്റെ വില ലഭിക്കും.

അതായത്
$$4x + 7 = 19$$
$$4x = 19 - 7$$
$$4x = 12$$
$$x = \frac{12}{4} = 3$$

തുടർപ്രവർത്തനങ്ങൾ

1. തുടർച്ചയായ 3 ഒറ്റ നിസർഗ്ഗസംഖ്യകളുടെ തുക 57 ആയാൽ സംഖ്യകൾ കണ്ടുപിടിക്കുക.
2. ഒരു ചതുരത്തിന്റെ നീളം, വീതിയേക്കാൾ 2 cm കൂടുതലാണ്. ചുറ്റളവ് 16 cm എങ്കിൽ ചതുരത്തിന്റെ നീളവും വീതിയും കാണുക.

Reference

1. Text Books of Std. V, VI, VII SCERT 2014.
2. Handbook of Std. V, VI, VII, SCERT 2014.
3. കണക്കറിവ്, ഡോ. ഇ.കൃഷ്ണൻ, ശാസ്ത്രസാഹിത്യ പരിഷത്ത് 2013
4. ICT Resource CD in Education - ICT resources Ubundu

Appendix-F2

Self Learning Module in Mathematics for Pre-Service Students

Content Module

MODULE

A module is a self contained study material based on a particular content which helps the (earner to acquire the desirable objectives. It consists of introduction to the content, aims and objectives, basic concepts, sub concepts, supporting materials, evaluation, codifications, follow up activities and references.

This module aims to enabling and ensure the mastery among students as well as student teachers at primary level with the basic concepts of Mathematics and to transfer (or communicate) Mathematical ideas effectively. The content of this modules help us to understand Mathematical concepts deeply, to develop the retention about basic concepts of Mathematics and through this we can easily teach the particular content to the students. Modules are framed in the following order.

1. Module -I : Fractions
2. Module : II : Percentage
3. Module : III : Decimal numbers
4. Module IV : Ratio, Proportion
5. Module V : Geometry
6. Module VI : Algebra

Module - 1

FRACTIONS

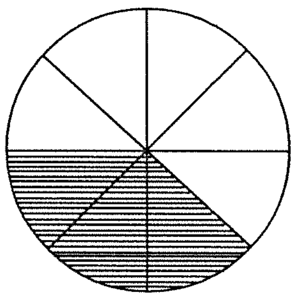
❑ Objectives

1. To develop the idea about properties of fractions and different kinds of fractions.
2. To understand and practise the operations with fractions.
3. To understand the properties of equivalent fractions.
4. To know the application of fractions at advanced level.

Content :

A fraction represents a part of a whole or it describes howmany parts of a certain size there are.

The following figure represents a circle which is divided into 8 equal parts and 3 parts are shaded. Here the shaded part is $\frac{3}{8}$ and the non-shaded part is $\frac{5}{8}$



That is, a particular portion of a whole can be termed as fraction.

If x and y are two integers and it can be written in the form $\frac{x}{y}$ with $y \neq 0$, then such numbers are called fractions. Here x is the numerator and y is the denominator of the fraction $\frac{x}{y}$

It is assumed that the denominator is a non-zero number.

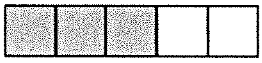
I. TYPES OF FRACTIONS

Fractions can be generally classfied in the following way.

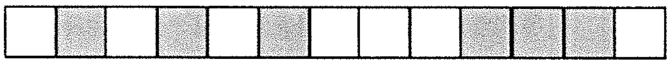
1. Proper Fraction

Fractions whose numerators are less than the denominators are called proper fractions. The value of proper fractions are always less than one.

Example $\frac{3}{5}$ Example $\frac{6}{13}$



$\frac{3}{5}$



$\frac{6}{13}$

2. Improper Fraction

Fractions with the numerator greater than the denominator are called improper fractions.

Example $\frac{4}{3}$, $\frac{5}{2}$

$\frac{1}{3}$ $\frac{1}{3}$ $\frac{1}{3}$ $\frac{1}{3}$

$$= 4 \times \frac{1}{3} = \frac{4}{3}$$

$\frac{4}{3}$ is the sum of four one thirds.

- Value of an improper fraction is always greater than one.

3. Mixed Fraction

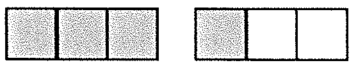
A combination of a simplest form of proper fraction and a whole number is called mixed fraction.

- A mixed fraction can be converted into an improper fraction and vice versa.

  Example: $3\frac{1}{4} = \frac{(4 \times 3) + 1}{4} = \frac{13}{4}$

  $$\frac{13}{4} = 4\overline{)13}\ \begin{array}{r} 3 \\ \hline 12 \\ \hline 1 \end{array} = \frac{4 \times 3}{4} + \frac{1}{4} = 3\frac{1}{4}$$

- Value of a mixed fraction is always greater than one.

  It can also be represented as 

  That is a whole one and one third of the whole.

II. FRACTIONS - MORE FACTS (Properties of Fractions)

(i) Value of a fraction does not change when its numerator and denominator is multiplied or decided by a particular number.

Example: $\frac{4 \times 2}{3 \times 2} = \frac{8}{6} = \frac{4}{3}$

Example: $\frac{4 + 2}{3 + 2} = \frac{5}{6} = \frac{4}{3}$

But the value chances when a particular number is added or substracted from the numerator and denominator.

(ii) To convert an improper fraction to a mixed fraction, divide the numerator by the denominator of that improper fraction, and obtain the quotient and remainder. The quotient will be the whole part and the fraction part has the remainder as numerator and the devision as the denominator.

(iii) Wehn a mixed fraction is converted to an improper fraction, the denominator remains the same.

4. Compound Fraction or Fraction of fraction

A compound fraction is a fraction of a fraction.

Example: $\frac{4}{5}$ th of $\frac{2}{3} = \frac{2}{3} \times \frac{4}{5} = \frac{8}{15}$

5. Compound Fraction

A complex fraction is a fraction where the numerator, denominator or both contain a fraction.

Example: $\frac{\left(\frac{2}{3}\right)}{5}$, $\frac{6}{\left(\frac{7}{11}\right)}$, $\left(\frac{7}{11}\right) \Big/ \left(\frac{9}{11}\right)$

6. Unit Fraction

A unit fraction is a rational number written as a fraction where the numerator is one and the denominator is a positive integer.

Example: $\frac{1}{5}$, $\frac{1}{10}$, $\frac{1}{25}$ ....

7. Equivalent Fractions

The numerator and the denominator of a fraction must be multiplied or divided by the same nonzero whole number inorder to have equivalent fractions.

Example: $\frac{2}{3} = \frac{2 \times 4}{3 \times 4} = \frac{8}{12}$

Instead of using LCM method in the operations involving addition and subtraction of fraction, we can also equivalent fraction method.

Example: $\frac{1}{4} + \frac{2}{3} = \frac{3}{12} + \frac{8}{12} = \frac{11}{12} = \frac{11}{12}$

III. ADDITION AND SUBTRACTION OF FRACTIONS

(i) Addition of fractions

Fractions are used to indicate the measurements. The basis of operations involving fractions is, to be produce different measurements in different way from the particular measurements using Mathematical operations.

Example : What is the total length of a stick if it is made by joining the ends of two sticks having length of half of the particular and other one is having length of one third of the particular length.

Suppose we measure the length using one sixth of a particular length. Then length of the first stick is three and that of second is two. That is, five one sixth of the length

Mathematically, $\frac{1}{2} + \frac{1}{3} = \frac{3}{6} + \frac{2}{6} = \frac{5}{6}$

The algebraic expression for addition of fractions is

$$\boxed{\frac{a}{b} + \frac{c}{d} = \frac{ad + bc}{bd}}$$

- To calculate the sum of two fractions with like denominator, just add their numerator and write their common denominator.

Example: $\frac{4}{7} + \frac{11}{7} = \frac{15}{7}$

- In the case of fractions with unlike denominator,
  - (i) If one denominator is a factor of the other then the least common multiple (LCM) is the largest number among them.
  - (ii) If denominators have no common factors then their LCM is equal to the product of their denominator.

Example: $\frac{5}{7} + \frac{6}{5} = \frac{25 + 42}{35} = \frac{67}{35}$

Another method :-

An example for calculating the sum of the fraction by equalizing denominators.

$\frac{4}{7} + \frac{5}{21}$ LCM = 21

Here the denominators are 7 and 21.

$$= \left[\frac{4}{7} \times \frac{3}{3}\right] + \left[\frac{5}{21} \times \frac{1}{1}\right] = \frac{12}{21} + \frac{5}{21} = \frac{17}{21}$$

Seven is a factor of 21 ($3 \times 7 = 21$) hence

$\frac{4}{7}$ is multiplied by $\frac{3}{3}$ resulting in $\frac{17}{21}$

iii) Common factor

- **Method of finding the sum of mixed fractions.**

  To calculate the sum of mixed fractions, first it's to be converted into improper fraction and then proceed as in the earlier case.

  Example: $1\frac{1}{3} + 2\frac{1}{4}$

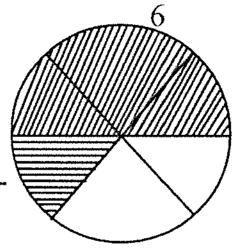
  Converting to improper fraction $= \frac{4}{3} + \frac{9}{4}$

  LCM of denominators = 12

  $= \frac{4}{3} \times \frac{4}{4} + \frac{9}{4} \times \frac{3}{3}$

  $= \frac{16}{12} + \frac{27}{12} = \frac{16+27}{12} = \frac{43}{12} = 3\frac{7}{12}$

Picturisation of sum of fractions.



From the figure, $\frac{3}{6} + \frac{1}{6} = \frac{4}{6}$

2. Subtraction of fractions

- The rules using subtraction of fractions are same as the rules of addition of fractions.

උදා: (i) $\frac{3}{4} - \frac{2}{7}$

$= \frac{3}{4} \times \frac{7}{7} - \frac{2}{7} \times \frac{4}{4} = \frac{21}{28} - \frac{8}{28} = \frac{21-8}{28} = \frac{13}{28}$

(ii) A half meter long string is cut from a string of length one and three fourth. Then what is the length of remaining string ?

Length of remaining string $1\frac{3}{4} - \frac{1}{2}$

$= 1 + \frac{3}{4} - \frac{1}{2}$

$= 1 + \frac{3}{4} - \frac{1}{2}$

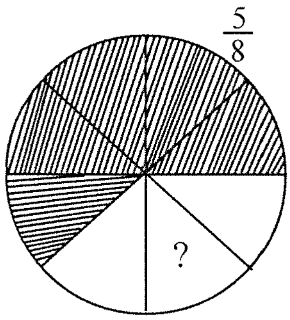
$= 1 + \left(\frac{3}{4} - \frac{1}{2}\right) = 1 + \frac{1}{4} = 1\frac{1}{4}$ metre

(iii) One and three fourth kilogram pumpkin is cut from the three and half kilogram pumpkin. What is the mass of remaining pumpkin?

Remaining pumpkin $= 3\frac{1}{2} - 1\frac{3}{4} = \frac{7}{2} - \frac{7}{4}$

$= \frac{14}{4} - \frac{7}{4} = \frac{7}{4} = 1\frac{3}{4}$ Kilogram

eg:



Represent the portion not shaded.

$= 1 - \frac{5}{8} = \frac{8}{8} - \frac{5}{8} = \frac{3}{8}$

IV. MULTIPLICATIONOF FRACTIONS

The operation which used to find the parts of a whole is called multiplication of fractions.

For example $\frac{4}{5}$ th part of $\frac{2}{3}$ th $= \frac{2}{3} \times \frac{4}{5} = \frac{8}{15}$ part

Another method,

$12 \times \frac{1}{4}$ = One fourth of 12 = $12 \times \frac{1}{4} = 3$

$= \frac{1}{4}$ th of 12 $= 3$

- To multiply fractions, multiply the numerator of the fractions to get the new numerator and multiply the denominator of the fractions to get new denominator.

Example : $\frac{3}{8} \times \frac{4}{7}$, $\frac{3 \times 4}{8 \times 7} = \frac{12}{56}$

- In the case of mixed fractions, first convert them into improper fraction and proceed as the previous case.

Example : $6\frac{2}{3} \times 7\frac{1}{4}$, $\frac{20}{3} \times \frac{29}{4} = \frac{20 \times 29}{3 \times 4} = \frac{580}{12}$

V. DIVISION OF FRACTIONS

A fraction which when multiplied by another fraction gives one is called reciprocal of the fraction.

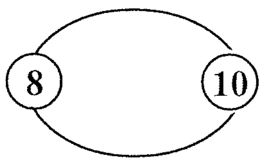
Examples : How many times of $\frac{2}{5}$ is equal to 1 ?

- Two $\frac{2}{5}$ are combined to get $\frac{4}{5}$
- How many $\frac{1}{5}$ are needed, in order to have 1 ?
- $\frac{1}{5}$ is the half of $\frac{2}{5}$
- In order to have 1, need 2 times of $\frac{2}{5}$ and $\frac{1}{2}$
- That is, $2\frac{1}{2}$ times $= \frac{2}{5}$ ന്റെ $2\frac{1}{2}$ times

$$\frac{3}{2} \times \frac{4}{5} = \frac{12}{10} = 1\frac{1}{5} \text{ times}$$

Explanation

$\frac{5}{4}$ times



$\frac{4}{5}$ portion

Here $\frac{5}{4}$ Times of 8 is equal to 10. That is 8 is equation $\frac{4}{5}$ times of 10. Thus instead of dividing the fraction we can obtain same result through multiplying by the reciprocal.

Example : $\frac{4}{6} \div \frac{3}{8} = \frac{4}{6} \times \frac{8}{3} = \frac{32}{18}$

VI. COMPARISON OF FRACTIONS

- To compare 2 fractions, multiply the numerator of first fraction with denominator of 2nd fraction, and then multiply denominator of first fraction with numerator of second fraction.
- If the first product is larger, then first fraction is larger.

- If the second product is larger, then second fraction is larger -

  Example: Compare $\frac{1}{6}$, $\frac{3}{8}$

  $1 \times 8 = 8$ and $6 \times 3 = 18$

  Here second product is larger. Therefore $\frac{3}{8}$ is larger fraction.

  - In the case of fractions with like numerators, then the larger fraction is the one with the smaller denominator. And smaller fraction is the one with the greater denominator.
  - When comparing two fractions with like denominators, the larger fraction is the one with the greater numerator and another one is smaller.

ICT - Integration

1. J Fraction Lab - Free style option.
2. Part of parts : Ubuntu School Resources. (Std. VI)
3. TLM - Fraction Disc

Codification

- A fraction is a number which represent a part of a whole which is divided into equal parts.
- Fractions can generally classified into proper fractions, improper fractions, and mixed fractions.
- Equivalent fractions are obtained by multiplying or dividing the numerator and denominator of a fraction with a particular number.
- Concept of LCM or equivalent fractions can be used for the calculation of sum and difference of a fraction.
- Interpreted (Annotated) the terms parts (portions) and times as the multiplication of fractions.
- By considering multiplication of fraction equivalent to the part of parts in order to find the product.
- The concept of reciprocal is used to reverse parts and times.
- Division is defined as the multiplication with reciprocals.

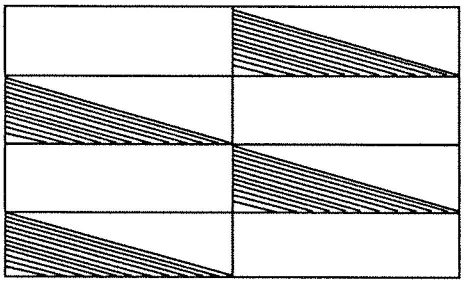
Follow up activities

1. Convert the following fractions into mixed fraction.

   (i) $\frac{20}{3}$ (ii) $\frac{11}{5}$ (iii) $\frac{25}{7}$

2. Express $\frac{42}{28}$ in its simplest form.

3.



Write the number corresponding to the shaded portion in this figure.

4. Calculate the following

(i) $2\frac{2}{3} + 1\frac{1}{3}$

(ii) $\frac{7}{5} + \frac{4}{7} - \frac{3}{8}$

(iii) $\frac{13}{20} \times \frac{25}{16} \times \frac{5}{4}$

(iv) How many times of $\frac{3}{7}$ is equal to 1 ?

(v) A 16 metre long wire is cut into $\frac{2}{3}$ m long pieces. How many such pieces are there ?

(vi) How many $\frac{3}{4}$ litre bottles are required to fill $5\frac{1}{4}$ litre water ?

Reference :

(i) Text books of Std. V, VI, VIII - SCERT (2013)

(ii) Hand books of Std. V, VI, VII - SCERT (2014) (teacher text)

MODULE - 2

PERCENTAGE

Introduction

Percentage is the mathematical idea which is widely used in the fields of business, industry, banking, insurance, share market, research etc. This module is designed on percentage.

Objectives

1. To understand the concept of percentage.
2. To know the applications of percentage in various fields.

The main ideas

- Percentage is a number that is expressed as a the number of parts of something divided into '100' equal parts. The term percentage means per cent or per hundred. It is often denoted using the sign '%'.
- x% means $\frac{x}{100}$. That is any percentage can be converted into fraction by writing the given number as numerator and 100 as denominator.
- Fractions and decimal numbers can be converted into percentages by multiplying with 100.

  Example: $\frac{1}{2} \times 100\% = 50\%$ $\qquad$ $\frac{3}{4} \times 100\% = 75\%$

  $0.7 \times 100\% = 70\%$ $\qquad$ $0.65 \times 100\% = 65\%$

Fractions and their corresponding percentage

Fractions	Percentage
$\frac{3}{4}$	75%
$\frac{1}{4}$	25%
$\frac{1}{16}$	$6\frac{1}{4}\%$
$\frac{1}{32}$	$3\frac{1}{8}\%$
$\frac{2}{3}$	$66\frac{2}{3}\%$

Fractions	Percentage
$\frac{1}{12}$	$8\frac{1}{3}\%$
$\frac{1}{10}$	10%
$\frac{1}{100}$	1%
$\frac{1}{3}$	$33\frac{1}{3}\%$
$\frac{1}{2}$	50%

Fractions	Percentage
$\frac{1}{8}$	12½%
$\frac{1}{32}$	$3\frac{1}{8}\%$
$\frac{1}{6}$	$16\frac{2}{3}\%$
$\frac{1}{5}$	20%
$\frac{1}{20}$	5%

Fractions	Percentage
$\frac{1}{25}$	4%
$\frac{18}{25}$	72%
$\frac{18}{50}$	36%

Examples

(i) If 20% of a number is 300. Then find out the number?

Assume that x is the number

20% of x = 300

$$x \times \frac{20}{100} = 300$$

$$\therefore x \times \frac{300 \times 100}{20} = 1500$$

(ii) The number 40 is increased to 60. Calculate the percentage of increase.

Increased value (Difference) = 20

That is $\frac{20}{40} \times 100 = 50\%$

(iii) If 100 is reduced into 60. Then what is the percentage of decrease ?

Decreased value (Difference) = 40

That is $\frac{40}{100} \times 100 = 40\%$

> If the number 'A' is increased by x%. Then new number will be (100 + x)% of A and if 'A' is decreases by x% then new number will be (100 – x) % of A.

Example :

1. What will be the new value if 600 is increased by 10% ?

10% of 600 = $600 \times \frac{10}{100} = 60$

$\therefore$ New value = 600 + 60 = 660

2. A number became 4000 when it increases by 25% then find the number?

Assume that x is the number (Let x is the number)

That is $x \times \frac{125}{100} = 4000$ $\quad \therefore x = \frac{4000 \text{ x } 100}{125} = 3200$

Applications of percentage

is widely used in many situations in our daily life. Profit (gain), loss, discount etc.

- Profit (gain) = Selling price – Cost price
- Loss = Cost price – Selling price
- Profit percentage (Gain percentage) = $\frac{\text{Profit}}{\text{Cost price}} \times 100$
- Loss percentage = $\frac{\text{Loss}}{\text{Cost price}} \times 100$
- Selling price = $\frac{\text{Cost price} \times (100 + \text{profit percentage})}{100}$
- Discount = Lost price – Selling price
- Discount percentage = $\frac{\text{Discount}}{\text{List price}} \times 100$
- Percentage can be represented by using pie diagram.

Examples

(i) 11 pens are purchased for 100 rupees. If 10 pens are sold for 110 rupees. Then calculate the profit percentage ?

<u>Analysis / Answer</u>

Cost price of 11 pens = 100 rupees

Selling price of 10 pen = 110 rupees

$\therefore$ Selling price of 1 pen = $\frac{110}{10} = 11$ rupees

$\therefore$ Profit got by selling 11 pen = 121 – 100 = 21 rupees

$\therefore$ Profit percentage = $\frac{\text{Profit}}{\text{Cost price}} \times 100 = \frac{21}{100} \times 100$

= 21%

(ii) If we get a pen as free, with the same price of the book purchased, then calculate the percentage of discount ?

Analysis / Answer

Here, assume that one book is free when get two

$\therefore$ Discount percentage = $\frac{1}{2} \times 100 = 50\%$

Codification

- A statement / fact is said to be in percentage. When it is to relate with 100 or parts – 100
- Whole is considered as 100%.
- In order to find 20% and 75% of a number, it is enough to calculate $\frac{1}{5}$ and $\frac{3}{4}$ of the number respectively.
- 200% and 300% are double of percentage and triple of percentage respectively.
- To find 1% of a number it is enough to find $\frac{1}{100}$ of the number.

ICT Slot : Ubundu → Chart → Piediagram

Follow up activities

1. What is the 20% of 64 ?
2. How much percentage of 36 is 9 ?
3. Calculate the percentage of success. If 6 out of 36 students failed ?
4. A pen was given as when 12 pens were brought. Find the percent of discount.
5. When a number increased by 12%, it became 896, then which is the number?

Reference :

1.Text books of Std 7-SCERT(2013)

2..Ganithakouthukam-Kerala Shasthra sahithya parishad(2000)

MODULE - 3

DECIMAL NUMBERS

Introduction

While trying to write the numbers and fractions in place value system, difficulty was felt in the case of fractions. In this situation a Chinese Mathematician 'Yang Hai' came up with the concept of conversion of fractions to decimals in the 13^{th} century.

Objectives

1. To understand the basic concepts of decimal numbers.
2. To attain the ability to solve the problems involving decimal numbers.

Basic concepts

1. The fractions whose denominators are 10, 100, 1000 etc. called decimal numbers.
2. It is possible to convert all decimal numbers into fractions and all fractions into decimal numbers.
3. If digits are repeating after the decimal point in a decimal number of a fraction, then it is called recurring or repeating decimal.

   eg: (1) $\frac{1}{3} = 0.3333 ......$ (2) $\frac{1}{7} = 0.142857142857......$

4. Decimal number has two parts,

   (i) Whole part and (ii) Decimal part

   - The right part of decimal point (preceding part) is called whole part.
   - The left part of decimal point is called decimal part.

   Example : In the number 124.375

   Whole part = 124

   Decimal part = 0.375

Basic operations of decimal numbers

- To add or subtract any 2 decimal numbers, the number of decimal places should be equal.

Addition

528 + 52.8 + 5.28 + 0.528

```
528.000  +
 52.800
  5.280
  0.528
------------
586.608
========
```

Subtraction

25.8 – 7.025

```
25.8000  –
 7.0250
-----------
18.7750
=======
```

Multiplication

To multiply two decimal numbers multiply them as whole numbers ignoring the decimal points. And insert the decimal point in the product by counting as many places from right to left as the total number of digits after the decimal point in the multipliers.

$2.5 \times 4 = 1.00$

Division

When dividing a decimal number by another decimal number the divisor (denominator) should be a whole number. To convert denominator into a whole number, multiply denominator and numerator (Divisor and dividend) by the numbers 10, 100, 1000, etc. in accordance to the number of place value, then proceed division.

After that, insert decimal point in the quotient in accordance with the place value of dividend.

eg: $\frac{0.9}{0.15} = \frac{0.9 \times 100}{0.15 \times 100} = \frac{90}{15} = 6$

Note : (i) $3.456 \times 10 = 34.56$, $3.456 \div 10 = 0.3456$

$3.456 \times 100 = 345.6$, $3.456 \div 100 = 0.03456$

$3.456 \times 1000 = 3456.$, $3.456 \div 1000 = 0.003456$

(ii)

12×12	= 14.4	$12 \div 12$	= 1
12×1.2	= 14.4	$12 \div 1.2$	= 10
1.2×1.2	= 1.44	$12 \div 0.12$	= 100
0.12×1.2	= 0.144	$12 \div 0.012$	= 1000
0.12×0.12	= 0.0144	$12 \div 0.0012$	= 10000

Codification

- Decimal numbers are the fractions whose denominators are the powers of 10.
- It is possible to write all fractions as decimal numbers and vice versa.
- When two decimal numbers are added, the number of decimal places should be equal. If not, add zero to equalize the decimal places.
- To multiply two decimals multiply them as a whole numbers and insert the decimal point in the product, by counting as many places from right to left as the sum of number of decimal places of the given numbers
- When dividing a decimal number by another decimal number, the divisor (denominator) should be converted to a whole number. Which can be done by multiplying powers of 10 as the number of decimal places in the denominator (both numerator and denominator must be get multiplied).

Follow up activities

1. Find the fraction equal to the decimal number 0.006 ?
2. Write the decimal number equal to ½ ?
3. Which number is added to 28.09 inorder to get 50 ?
4. How many meter is equal to 45 c.m ?
5. How many litre is equal to 455 ml ?

Reference :

1.Text book of std VI-(2015)-SCERT

2.Teacher Text of Std VI-(2012)-SCERT

MODULE - 4

RATIO - PROPORTION

Introduction

Proportion is another form of fraction. The benefits of using proportion is clear while comparing more than two measures. Ratios and proportion are widely applicable in our daily life.

Objectives

1. To acquire an idea about the basic concepts of proportions as well as ratios.
2. To attain the ability to solve practical problems of ratios and proportions.

Basic Concepts

1. Proportion

This concept is used while comparing quantities.

Example: In a triangle

- The largest side is 1½ times of smallest side.
- Instead of saying, the middle side is 1½ times of smallest side, by taking ¼th portion of smallest side as unit, we can say that length of the sides of a triangle are in the ratio 4:5:6.

Other example:

- Plaster can be made by mixing cement and sand in the ratio 1:3. Which means that one require 3 pan sand for 1 pan cement.
- The ratio between teachers and students in school is 1:30.

If the quantities in the proportion were interchanged, then the idea also gets changed.

Simplifications of proportions

A proportion can be simplified by dividing each terms by a fixed number.

For example; To simplify the proportion 40:25. It is enough to divide both terms by 5.

That is, 40:25 = 8:5

Like that, if we multiply the terms of a proportion by a fixed number. It will expand.

Example: If we multiply 2:5 by 3, we obtain

6 : 15

i.e., suppose, the fixed number is x. Then,

a:b = ax = bx

2. Ratio

A new proportion obtained by the expansion or simplification of a proportion will be equal to the first. These equality of two proportion is called ratio.

That is, if a:b = c:d then a:b and c:d are in proportion.

- If two proportions are in ratio, then product of last terms and products of middle terms will be equal.

  That is if ratio a:b = c:d then

  $\boxed{a \times d = b \times c}$

  Also, $a = \frac{bc}{a}$, $b = \frac{ad}{c}$, $a = \frac{bc}{d}$, $c = \frac{ad}{b}$

Problem

If 2:5 = x : 20 then what is the value of x ?

$$x = \frac{2 \times 20}{5} = \frac{40}{5} = 8$$

Equal ratio / Equivalent ratio

If 2 measures are changing in the same way, then the change is in equal ratio.

- The number and prices of books are given in the following table.

No. of books	1	2	3	4	5	6	7
Cost of books	6	12	18	24	30	36	42

Here, $\frac{1}{6} = \frac{2}{12} = \frac{3}{18} = \frac{4}{24} =$ .... are in equal ratio.

Opposite Ratio

In some cases the changes will be opposite then they are called as in opposite ratio.

Example : Speed and corresponding time given in the following table.

Speed (Km/ hr)	60 km	50 km	30 km	20 km	10 km
Time (hrs)	5 hrs	6 hrs	10 hrs	15 hrs	30 hrs

From the above table it is clear that, as speed decreases time increases. This change is in opposite ratio.

Let x_1, x_2, x_3 .... are the speed and y_1, y_2, y_3 .... are respective time.

Then, $\frac{x_1}{x_2} = \frac{y_1}{y_2}$

Example :

If 8 persons needs 24 days to complete a work then how many days will take to complete the same work by 6 persons.

Answer

Consider x as the number of persons and y the number days, then

$x_1 = 8, \quad x_2 = 6, \quad y_1 = 24, \quad y_2 = ?$

$$\frac{x_1}{x_2} = \frac{y_2}{y_1} = \frac{8}{6} = \frac{y_2}{24} = y_2 = \frac{24 \times 8}{6} = 32$$

$\therefore$ 6 persons needs 32 days to complete the work.

Method to divide a particular number in a particular proportion.

Method to devide number x in the ratio a:b:c.

- First, add three terms in the proportion = a + b + c

$\therefore$ First part $= x \times \frac{a}{a+b+c}$

Second part $= x \times \frac{b}{a+b+c}$

Third part $= x \times \frac{c}{a+b+c}$

Example:

Divide Rs. 800/- in the ratio 2:3 for Raman & Gopi.

Answer

Sum of the terms in the proportion = 2 + 3 = 5

(Portion) Part of Raman = $\frac{2}{5} \times 800 = 320$

Part of Raman = $\frac{3}{5} \times 800 = 480$

ICT slot → Ubundu → School Resources → Ratio and Proportion

Consolidation

- The proportion between a & b is represented as a:b.
- If a:b and c:d are in same ratio, then we can represent a:b = c : d.
- If a:b = c:d then $\frac{a}{b} = \frac{c}{d}$ i.e., ad = bc

  If we multiply or divide the terms of a proportion with a fixed number, we obtain proportions in equal ratio.

Follow up activities

1. Find the value of x if $8 : x = 16 : 10$?
2. Find the proportion which is equivalent to $\frac{1}{5} : \frac{1}{3}$
3. If the age of three persons are in the ratio 2:3:4 and sum of their age equal to 54. Then what is the age of the eldest.
4. Divide the number 3500 in the ratio 4:3.

Reference :

1. Text books of std. V, VI, VII - SCERT (2013)
2. Teacher text of Std. V, VI, VII - SCERT (2013)

MODULE - 5
GEOMETRY

Introduction

Ancient people had the knowledge about different shapes in the nature in addition to the concept of numbers. They observed line, in the path of river and growing trees, circles in celestial bodies etc. and found triangles in huge hills. The usage of measurements became essential for determining the boundary of fields, construction etc. In this way a new branch of Mathematics was formed, later it is known as Geometry which relatives numbers with shapes.

Geometry was originated from the essentiality of finding length, area, volume etc. for solving practical problems. Later they tried to find the perimeter and area of the shapes like triangle, square, circle etc. and formulated important Mathematical principles related to it.

This module explains the basic concepts and applications of Geometry.

Objectives

- To improve the retention about the basic concepts of geometry.
- To attain the ability to apply the concepts of geometry in suitable situations.

(i) Geometry and measurement

Consider a long thread or ribbon. Here only relevant thing is length of the thread. Thus, the measurements relating only to length is called one dimensional quantities. In the case of a paper sheet, it has both length and breadth. Like this, a measurement which has length and breadth is called two dimensional quantities.

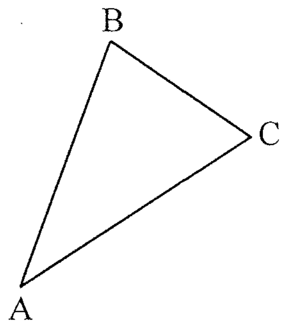
Now imagine a cube, it has length, breadth and height such measurements are called three dimensional quantities.

(ii) Lines

A straight line is most simplest geometric shape. Every line has fixed length. These lines can be extended according to our need. So in geometry a line is a straight path which can be extended infinitely. In our practical needs we use piece of lines having fixed length. These piece (section) of line is called line segment.

(iii) Planes

A plane is a flat surface formed by the inclusion of 3 points in a particular surface. The shortest path between two points in a plane is line segment.



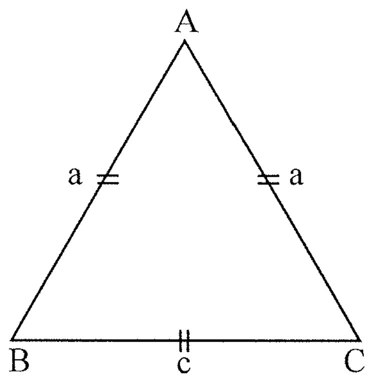
In the figure the shortest length between A & B is AB. If we join the line segment AC and CB we get another path from A to B. $\therefore$ We get $AC + BC > AB$. By repeating this using another points, we get that the sum of the length of any 2 sides of a triangle will be greater than that of the 3rd side.

Different Plans

1. Triangle

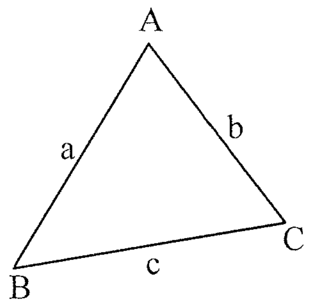
A triangle is a closed figure with 3 sides.

(i) Equilateral triangle



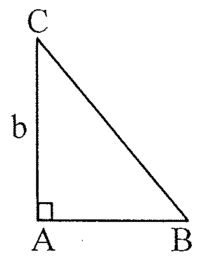
- If the length of an three sides of a triangle are equal then it is called equilateral triangle.
- Every angles in an equilateral triangle are equal to 60^0.
- The perimeter of an equilateral triangle = 3a
- Area $= \frac{\sqrt{3}}{4} a^2$

(ii) Scalene triangle



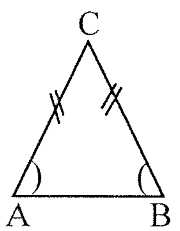
- A scalene triangle is a triangle that has three unequal sides.
- Perimeter = a + b + c (sum of 3 sides)
- Area = $\sqrt{S(s-a)(s-b)(s-c)}$ and $S = \frac{a+b+c}{2}$

(iii) Right angled triangle



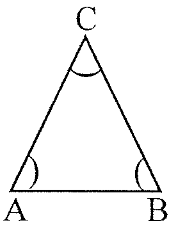
- If any one of the angle of a triangle is 90^0 then such triangle is called right angled triangle.
- If the base of right angled angle is 'b' its attitude (height) is 'h' then area = ½bh sq. unit.

(iv) Isosceles triangle



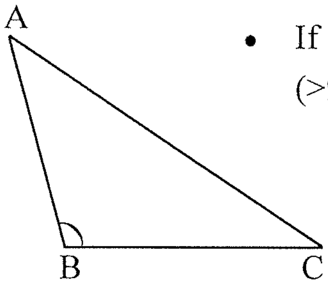
- An isosceles Δ is a triangle that has two sides of equal length.
- The base angles of a isosceles Δ will be equal.

(v) Acute triangle



- If all 3 angles of a are Δ are acute angle (<90⁰). Then it is called acute Δ..

(vi) Obtuse triangle

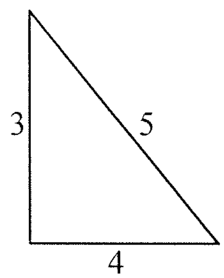


- If any one of the angle of a triangle is obtuse angle (>90^0) then such triangles are called obstuse triangles.

Other features

- The sum of all 3 angles in any triangle in a plane will be equal to 180^0.
- If altitude, base and hypotenuse of a right angled triangle are a, b, and c respectively. Then, $c^2 = a^2 + b^2$. This is Pythagorean theorem.
  i.e., $\text{Hypotenuse}^2 = \text{Base}^2 + \text{Altitude}^2$

  In a triangle, the length of largest side will be less than that of the other 2 sides.

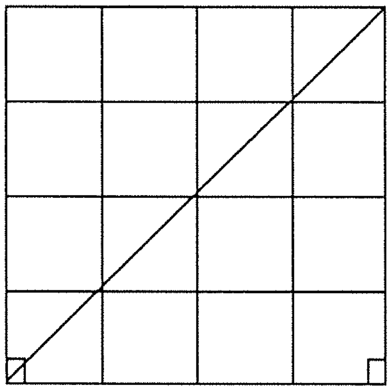


$3^2 + 4^2 = 5^2$

Pythagorean theorem

Quadrilaterals

A quadrilateral is a closed figure which consists of 4 sides. 6 different types of quadrilaterals are given below.

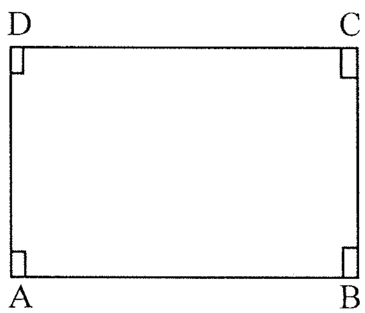


- If all sides of a quadrilateral are equal and all angles are equal to 90^0, then the quadrilateral is called as square.
- Perimeter of a square = $4a$
- Area of a square = a^2
- If length of one side is a, then the length of its diagonal is equal to $\sqrt{2}a$

$$\left[\begin{aligned} d &= \sqrt{a^2 + a^2} \\ &= \sqrt{2a^2} \\ &= \sqrt{2}a \end{aligned}\right]$$

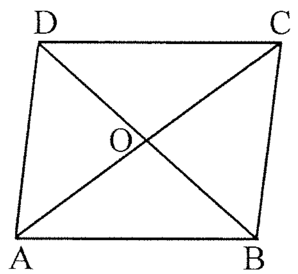
(ii) Rectangle

If the opposite sides of a quadrilateral are equal and all angles are 90^0, then such quadrilateral is called rectangle.



- Perimeter of the rectangle = 2 (length + Breadth)
- Area of the rectangle = Length × Breadth
- If length of a rectangle is equivalent to that of breadth then it will a square.

(iii) Parallelogram

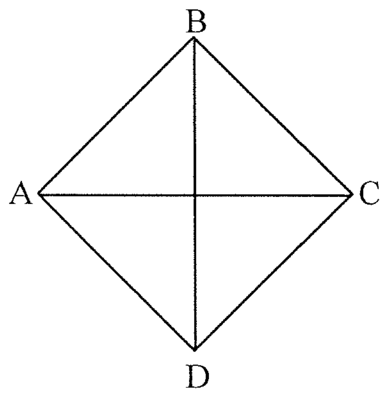


- A parallelogram is a quadrilateral with opposite sides parallel and equal in length.
- The diagonals of a parallelogram bisect each other.
- Let 'b' is length of one side of a parallelogram, and n is the attitude. (perpendicular height) then,

  Perimeter = 2 (a + b), a, b are parallel sides

  Area = bh

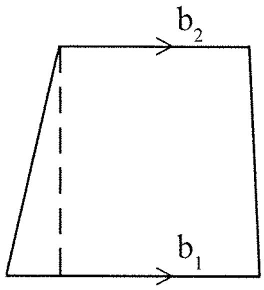
(iv) Rhombus



- A rhombus is a parallelogram with four equal sides and opposite angles equal.
- Perimeter of a rhombus = 4 × length of one side
- Area = bh or ½ $(d_1 \times d_2)$

  Where d_1 , d_2 are the diagonals.

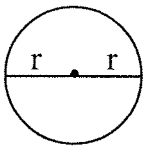
(v) Trapezium



- A trapezium is a quadrilateral with one pair of sides parallel.
- If the parallel sides of a trapezium are b_1, b_2 respectively and the distance b/w them is h then,

  Area of trapezium $= \frac{1}{2}(b_1 + b_2)h$

(vi) Circles



- A circle is the set of all points in a plane that are equidistant from a given point.
- The particular given (fixed) point is centre and fixed distance is radius of the circle.
- If 'r' is the radius of a circle then its diameter is equal to 2r.
- 'π' is the number, obtained when circumference of any circle divided by its diameter.
- That is circumference of circle = 'π' $\times$ diameter
- Circumference of circle $= \pi \times 2r = 2\pi r$
- Circles have the largest area among the shapes having equal perimeter
- If the radius of a circle increase x times, then the area will be increases by x^2 times.
- If the radius of a circle increases x time, then the circumference will be increased by x times.
- As the number of sides of polygons increases, its area tends to the area of a circle.

- In figure - 2 given above, a circle is partitioned into triangles. By cutting these triangles and joining we get a shape like rectangle. And again partitioning the circle into more triangles, and join together we get a perfect rectangle. Here one side of the rectangle formed is half the circumference and it's breadth is radius of the circle. If the radius of the circle is r, then circumference is $2\pi r$. Therefore length of one side of the rectangle is,

  $= \frac{1}{2} \times 2\pi r = \pi r$

  breadth is r then,

  Area of rectangle $= \pi r \times r = \pi r^2$ = Area of circle

Applications

- Shapes of well, bangle, wheel etc.
- Manufacturing of pots (using rotating wheel).
- Invention of wheel is an important thing in the developmental path of human being.

Follow up activities

1. What is the length of the rectangle of its breadth is 12 cm and perimeter 60 cm ?
2. Find the area of a square if the length of diagonal 4 cm.
3. What is the area of a circle made by a rope of length 88 cm.
4. In a right angled triangle hypotenuse = 15 cm, Altitude = 9 cm then what is the length of base ?
5. Find the area and perimeter of a triangle, if lengths of its sides are 6 cm, 8 cm and 10 cm ?

1.Text books of Std V.VI,VII-SCERT(2015)
2.Teacher Texts of V,VI,VII(SCERT(2015)
3.GanithaKouthukan: Kerala sasthra sahithya parishad

MODULE - 6

ALGEBRA

Introduction

When the knowledge about numbers and their relations were increased, some general Mathematical principles were also developed. And later it became necessary to present these principles on numbers more accurately.

The shorthands became essential while converting practical problems to Mathematical ones to analyse, and to solve. Algebra or such shorthands are used to generalize the principles.

According to the famous poet 'Omarkhayam' "Algebra is a trick in obtaining unknowns has thought it in vain."

Variable

Variables are letters or symbols which are used in algebra instead of numbers. Values of variables are uncertain it may vary.

Example: x, y, α, β etc.

Sentences

Sentences represents an incomplete idea.

1. eg: (i) Sum of the number

   (ii) 3 times of a number

Other examples

2. $5 + 4, 8 - 7, 6 + 4 - 1$
3. $x + y + 5, a + b + 8, p + q + r$

All examples given above tells incomplete concepts. We can classify these sentences into three categories.

First 2 examples are completely stated in language. Hence such sentences are called language expressions. (ഭാഷാ വാചകങ്ങൾ)

The second two examples are completely stated using number. So they are called arithmetic expressions. (സംഖ്യാവാചകം).

Examples :

- Half of the sum of any two numbers -
- $8 + 4 - 2$ - Arithmetic expression / sentence / form
- $a + b \div 2$ - Algebraic expression / sentence

Method for converting to algebraic expression

- Express the concepts using variables instead of language for eg:- sum of two numbers.

Here we can take variable x & y or a & b instead of two different numbers.

That is sum of two numbers = $x + y$ or $a + b$.

Other examples

- Difference b/w two numbers = $x - y$
- 5 times of a number = $5x$ (take x as the number)
- Half of sum of two numbers = $\frac{x + y}{2}$
- Half of a number = $\frac{x}{2}$
- Square of the sum of two numbers = $(a + b)^2$

Thus, we can put variables instead of numbers in any concepts or sentences.

Different types of algebraic expression

1. **Monomial**

   An Algebraic expression containing only one term is called monomial.

   eg: $3x$, $5p$, $4a$

2. **Binomial**

   An algebraic expression containing two terms is called binomial.

3. **Trinomial**

   An algebraic expression having 3 terms is called trinomial.

   eg: $a + b + c$, $5x - 4y + 2z$

These all algebraic expressions are together called polynomials.

- Monomial is a polynomial having only one term.
- Binomial is a polynomial having two terms.

Examples

- If we add 7 to four times of a number, we get 19, then find out the number ?

Answer

Let x be the number.

We get the algebraic expression $4x + 7 = 19$

By solving this we get the value of x,

$$\begin{aligned} \text{i.e.,}\quad 4x + 7 &= 19 \\ 4x &= 19 - 7 \\ x &= \frac{12}{4} = 3 \end{aligned}$$

Follow up activities

- Sum of 3 consecutive odd numbers is 57. Then find the numbers ?
- Find the length and breadth of a triangle. If perimeter of the triangle is 16 cm and length is 2 cm greater than breadth ?

Reference

1.Text books of Std 5,6,7-SCERT
2.Teacher Text of Std 5,6,7
3. Kaanakkarivu-Dr.E.krishanan-KSSP
4.Text book-Std 7-NCERT

APPENDIX-F3

പ്രീ–സർവീസ്
വിദ്യാർത്ഥികൾക്കുള്ള

സ്വയം പഠന സാമഗ്രി

ഗണിതം
ബോധനശാസ്ത്ര മൊഡ്യൂൾ

ഭിന്നസംഖ്യകൾ

മൊഡ്യൂൾ - I

ഭിന്നസംഖ്യകൾ

ചരിത്രം

നിശ്ചിത ഏകകങ്ങളുടെ അടിസ്ഥാനത്തിൽ നീളവും ഭാരവും പരപ്പളവും വ്യാപ്തവും അളക്കേണ്ടിവന്നപ്പോൾ അതിന് എണ്ണൽ സംഖ്യകൾ പോരാതെ വന്നു. ഉദാഹരണമായി ഒരു നിശ്ചിത നീളമുള്ള ഒരു കമ്പി ഉപയോഗിച്ച് നീളങ്ങൾ അളക്കുമ്പോൾ അതിനേക്കാൾ ചെറിയ നീളങ്ങളെ എങ്ങനെ സൂചിപ്പിക്കും എന്ന പ്രശ്നം ഉണ്ടാകും. അപ്പോൾ കമ്പിയുടെ പകുതിയെയും മൂന്നിലൊന്നിനെയെല്ലാം സൂചിപ്പിക്കാനുള്ള സംഖ്യകൾ വേണ്ടി വന്നു. അപ്രകാരമാണ് ഭിന്നസംഖ്യകളുടെ ഉത്ഭവം.

ആമുഖം

അളവുകളിലൂടെ രൂപപ്പെടുന്ന ഭിന്നസംഖ്യകളെ കേവല ഗണിതാശയങ്ങളാക്കുമ്പോൾ, എണ്ണൽസംഖ്യകളിൽ നിന്നും വ്യത്യസ്തമായ പലതും കണക്കിലെടുക്കേണ്ടിവരും. ഉദാഹരണമായി പകുതി എന്ന ആശയം ആദ്യം വരുന്നത് രണ്ട് തുല്യഭാഗങ്ങളിൽ ഒന്ന് എന്ന രീതിയിലാണ്. അപ്പോൾ അതിനെ $\frac{1}{2}$ എന്നെഴുതാം.

ഇങ്ങനെ, നിത്യജീവിതവുമായി ബന്ധപ്പെട്ട വിവിധ സന്ദർഭങ്ങളിൽ അര, കാൽ, മുക്കാൽ തുടങ്ങിയ പ്രയോഗങ്ങൾ ഉണ്ട്. ഇത്തര പ്രയോഗങ്ങളെ ഗണിതപരമായി കൃത്യതപ്പെടുത്തുന്ന പ്രവർത്തനങ്ങളാണ് ഈ മൊഡ്യൂളിൽ ഉൾപ്പെടുത്തിയിട്ടുള്ളത്.

ഭിന്നസംഖ്യകൾ

ആമുഖം

പൂർണമായ ഒന്നിനെ തുല്യമായി വീതിക്കുമ്പോഴാണ് ഭിന്നസംഖ്യ ആവശ്യമായി വരുന്നത്. ഒന്നിനെക്കാൾ വലിയ സംഖ്യകളെ എണ്ണൽസംഖ്യയും ഭിന്നസംഖ്യയും ചേർന്ന രൂപത്തിൽ എഴുതാനും തിരിച്ച് എണ്ണൽ സംഖ്യയും ഭിന്നസംഖ്യയും ചേർന്ന രൂപത്തെ ഒരു ഭിന്നസംഖ്യയായി എഴുതാനും കുട്ടികൾക്ക് കഴിയണം. ഭിന്നസംഖ്യയുടെ സമാനഭിന്നം കണ്ടെത്തൽ, ഇവ ഉപയോഗിച്ചുള്ള ചതുഷ്ക്രിയകൾ, പ്രയോഗിക പ്രശ്നങ്ങൾ നിർധാരണം ചെയ്യൽ എന്നിവയിൽ ധാരണ ഉണ്ടാക്കുക എന്നതാണ് ഇത്തരം പ്രവർത്തനങ്ങളുടെ ലക്ഷ്യം.

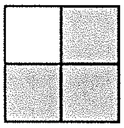
ആശയങ്ങൾ

1. ഭാഗങ്ങളുടെ സംഖ്യയാണ് ഭിന്നസംഖ്യ.
2. $\frac{3}{4}$ എന്നത് ഒരു വസ്തുവിനെ 4 തുല്യഭാഗങ്ങളാക്കിയതിന്റെ 3 ഭാഗമാണ്. ഇത് മൂന്ന് $\frac{1}{4}$ കൾ ചേർന്നതാണ്.
3. ഒരു ഭിന്നസംഖ്യയെ അതിന് തുല്യമായ മറ്റ് ഭിന്നസംഖ്യാ രൂപങ്ങളിൽ എഴുതാം.
4. ഭിന്നസംഖ്യയെ ഹരണക്രിയയായും ഹരണക്രിയയെ ഭിന്നസംഖ്യയായും വ്യാഖ്യാനിക്കാം.
5. ഭിന്നസംഖ്യകളുടെ സങ്കലനം
6. ഭിന്നസംഖ്യകളുടെ വ്യവകലനം
7. ഭിന്നസംഖ്യകളുടെ ഗുണനം
8. ഭിന്നസംഖ്യകളുടെ ഹരണം
9. ഒന്നിനേക്കാൾ വലിയ ഭിന്നസംഖ്യകളെ പൂർണ്ണ സംഖ്യകളും ഭിന്നസംഖ്യകളും ഉൾപ്പെടുന്ന രൂപത്തിൽ എഴുതാം.

പ്രീ-ടെസ്റ്റ് ചോദ്യങ്ങൾ

A. 1. ½ = ...

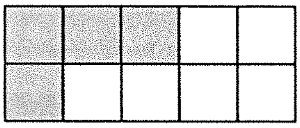
$$\left[\frac{3}{6},\ \frac{3}{4},\ \frac{2}{5},\ \frac{1}{4}\right]$$

2. 
ചിത്രത്തിൽ ഷെയ്ഡ് ചെയ്ത ഭാഗത്തെ സൂചിപ്പിക്കുന്ന ഭിന്നസംഖ്യ ഏത്?

3. ഏറ്റവും ചെറിയ ഭിന്നസംഖ്യ ഏത്?

$$\left[\frac{1}{6},\ \frac{1}{4},\ \frac{1}{3},\ \frac{1}{2}\right]$$

4. അംശം = 11, ഛേദം = 25 ഭിന്നസംഖ്യ എഴുതുക.

5.  ചിത്രത്തിൽ $\frac{4}{5}$ ആകാൻ എത്ര കളങ്ങൾ കൂടി ഷെയ്ഡ് ചെയ്യണം?

B. 1. $\frac{1}{3} + \frac{1}{4}$ എത്ര ?

2. രാജുവും സുമയും കൊട്ടയിലുള്ള മാങ്ങ എടുക്കുകയാണ്. രാജു ആകെയുള്ള തിന്റെ $\frac{1}{3}$ ഭാഗവും രമ ആകെയുള്ളതിന്റെ $\frac{1}{6}$ ഭാഗവും എടുത്തു. എങ്കിൽ കൊട്ടയിൽ ആകെയുള്ളതിന്റെ എത്ര ഭാഗം മാങ്ങ ബാക്കിയുണ്ട് ?

$\left[\frac{1}{2} , \frac{1}{3} , \frac{1}{6} , \frac{1}{18} \right]$

3. $\frac{4}{8} - \frac{2}{8}$ എത്ര ?

4. $\frac{1}{2}$ ന്റെ $\frac{1}{3}$ ഭാഗം എത്ര ?

5. $\frac{3}{12} \div \left[\frac{1}{3} \times \frac{1}{4} \right]$

$\left[\frac{3}{12} , \frac{1}{12} , \frac{1}{3} , \frac{3}{1} \right]$

6. $\frac{3}{5} - \frac{1}{3}$ എത്ര ?

7. താഴെ കൊടുത്തിരിക്കുന്നവയിൽ എല്ലാ ഭിന്നസംഖ്യകളും തുല്യമായത് ഏത്?

a. $\frac{1}{2} , \frac{2}{4} , \frac{4}{6}$ b. $\frac{2}{3} , \frac{4}{6} , \frac{8}{12}$ c. $\frac{2}{5} , \frac{4}{10} , \frac{8}{50}$

d. $\frac{3}{4} , \frac{4}{6} , \frac{6}{8}$

8. a. $\frac{1}{2} + \frac{1}{3}$ b. $\frac{1}{2} - \frac{1}{3}$ c. $\frac{1}{2} \times \frac{1}{3}$ d. $\frac{1}{2} \div \frac{1}{3}$

എന്നിവ കണ്ടുപിടിക്കുക.

9. a. $1\frac{1}{2} \div \frac{3}{4}$ എന്ന ക്രിയ വരുന്ന പ്രായോഗിക പ്രശ്നം രൂപീകരിക്കുക.

പ്രീ ടെസ്റ്റ് നടത്തിയപ്പോൾ എന്തൊക്കെ പ്രശ്നങ്ങളാണ് കണ്ടെത്തിയത്. കുട്ടി കൾ എഴുതിയ ചില ഉത്തരങ്ങൾ പരിശോധിക്കാം.

കുട്ടികൾക്ക് വരാവുന്ന തെറ്റായ ധാരണകൾ

1. $\frac{1}{5} + \frac{3}{5} = \frac{4}{10}$ (ഒരു വസ്തുവിനെ തന്നെ 5 തുല്യഭാഗമാക്കിയതിന്റെ ഭാഗങ്ങളാണ് $\frac{1}{5}$, $\frac{3}{5}$ എന്ന ധാരണയില്ലായ്മ)

2. $\frac{3}{4} + \frac{2}{3} = \frac{5}{7}$ (ഭിന്നസംഖ്യയുടെ മൂല്യത്തെക്കുറിച്ച് ധാരണയില്ല)

   $\frac{1}{2} + \frac{1}{2} = \frac{2}{4} = \frac{1}{2}$ എന്നത് ശരിയല്ല

3. $\frac{1}{2} + \frac{3}{4} = \frac{4}{6}$ [$\frac{1}{2}$, $\frac{3}{4}$ ചേർന്നാൽ 1-നേക്കാൾ കൂടുതലാണെന്ന ധാരണയില്ലായ്മ]

4. $\frac{3}{5} + \frac{1}{3} = \frac{2}{3}$ (മൂല്യത്തെക്കുറിച്ചും ഛേദം തുല്യമാക്കണമെന്നതിനെക്കുറിച്ചും ധാരണയില്ലായ്മ)

5. $\frac{2}{3} \times \frac{1}{3} = \frac{2}{3}$ (ഭിന്നസംഖ്യയുടെ ഗുണനത്തിൽ ഭാഗങ്ങളാക്കുകയാണെന്നും അളവുകൾ കുറയുന്നു എന്ന ധാരണയില്ലായ്മ)

6. $\frac{2}{3} \div \frac{4}{5} = \frac{8}{15}$ (ഭിന്നസംഖ്യകൾ തമ്മിലുള്ള ഹരണക്രിയയിൽ വ്യുൽക്രമം ഉപയോഗപ്പെടുത്തുന്നതിന്റെ യുക്തി ബോധ്യപ്പെടുന്നില്ല).

മുകളിൽ കൊടുത്ത ചില നിരീക്ഷണങ്ങൾ ശ്രദ്ധിച്ചുവല്ലോ. ഭിന്നസംഖ്യയുമായി ബന്ധപ്പെട്ട് ധാരാളം തെറ്റുകൾ വരുത്താറുണ്ട്. ഇത് പരിഹരിക്കാൻ എന്താണ് വഴി? ഉദാഹരണമായി $\frac{1}{2} + \frac{1}{3} = \frac{2}{5}$ എന്ന് ഉത്തരമെഴുതിയ കുട്ടിയെ ആദ്യം തെറ്റ് എന്താണെന്ന് ബോധ്യപ്പെടുത്തണം. $\frac{2}{5}$ എന്ന ഉത്തരം $\frac{1}{2}$ നെക്കാൾ ചെറുതാണ്. $\frac{1}{2} + \frac{1}{2} = \frac{2}{4} = \frac{1}{2}$ ആവുകയില്ലല്ലോ? പേപ്പറിൽ മുറിച്ചെടുത്ത ഭാഗങ്ങൾ ഉപയോഗപ്പെടുത്തി (പഠനസാമഗ്രികളുടെ സഹായത്തോടെ) $\frac{1}{2} + \frac{1}{3} = \frac{5}{6}$ എന്ന് കണ്ടെത്താൻ കഴിയും. തുടർന്ന് മാത്രമേ ക്രിയയിലേക്ക് പോകേണ്ടതുള്ളൂ.

$\frac{1}{2} \times \frac{1}{3}$, $1\frac{1}{2} \div \frac{3}{4}$ തുടങ്ങിയ ക്രിയകൾ വരുന്ന പ്രായോഗിക പ്രശ്നങ്ങൾ നിർമ്മിക്കുന്നത് ഭിന്നസംഖ്യകളുടെ ഗുണനം ഹറണം എന്നിവയിൽ കൂടുതൽ തെളിച്ചമുണ്ടാക്കാൻ സഹായിക്കും. $\frac{1}{2} \div \frac{1}{3}$ എന്നതിൽ ക്രിയ ചെയ്യുമ്പോൾ വ്യുൽക്രമംകൊണ്ട് ഗുണിക്കുന്നതിന്റെ യുക്തി കുട്ടികൾക്ക് ബോധ്യപ്പെടണം. $\frac{1}{2} \div \frac{1}{3} = \frac{1}{2} \Big/ \frac{1}{3}$ ഇതിൽ ഛേദം ഒഴിവാക്കാൻ അംശത്തെയും ഛേദത്തെയും $\frac{3}{1}$ കൊണ്ട് ഗുണിച്ചാൽ മതി. $\left[\frac{1}{2} \times \frac{3}{1}\right] \div \left[\frac{1}{3} \times \frac{3}{1}\right] = \frac{1}{2} \times \frac{3}{1} \div 1 = \frac{3}{2}$

അതോടൊപ്പം ഇതല്ലാതെയും മാർഗ്ഗങ്ങളുണ്ട്. ഭിന്നസംഖ്യകളെ ഹരണക്രിയയായി എഴുതാം എന്ന ആശയം ഉപയോഗപ്പെടുത്തിയാൽ $\frac{1}{2} \div \frac{1}{3} = (1 \div 2) \div (1 \div 3) = 1 \div 2 \div 1 \times 3 = 1 \div 2 \times 3 \div 1 = \frac{1}{2} \times \frac{3}{1} = \frac{3}{2}$ ഈ രീതിയിൽ വ്യത്യസ്ത സാധ്യതകൾ പരിചയപ്പെടുത്താം. കൂടുതൽ യുക്തമായ രീതി കുട്ടികൾ സ്വീകരിക്കട്ടെ. പ്രായോഗിക പ്രശ്നങ്ങൾ പരിഹരിക്കുന്നതിന് പ്രയാസം നേരിടുന്ന കുട്ടികൾക്ക് ഇത്തരം ക്രിയകൾ വരുന്ന പ്രശ്നങ്ങൾ നിർമ്മിക്കാൻ അവസരം നൽകണം.

പ്രവർത്തനം

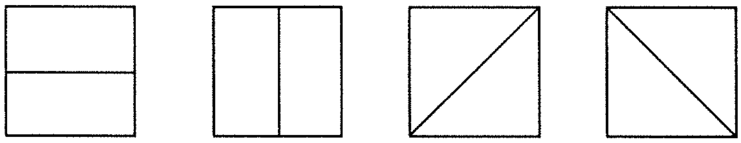
ക്ലാസ്സിൽ മുഴുവൻ കുട്ടികൾക്കും ചതുരാകൃതിയിലുള്ള ഒരു പേപ്പർ നൽകി രണ്ടായി മട ക്കാൻ ആവശ്യപ്പെടുന്നു.

എല്ലാവരും മടക്കിയത് നേർപകുതിയാണോ?

എല്ലാവരും ഒരേ രീതിയിലാണ് മടക്കിയതെങ്കിൽ ടീച്ചർ അടുത്ത നിർദ്ദേശത്തിലേക്ക് കടക്കുന്നു.

ഏതെല്ലാം രീതിയിൽ നേർപകുതിയായി മടക്കാം ?

കുട്ടികൾ വ്യത്യസ്ത രീതിയിൽ മടക്കിയത് ടീച്ചർ BBയിൽ വരച്ചു കാണിക്കുന്നു.



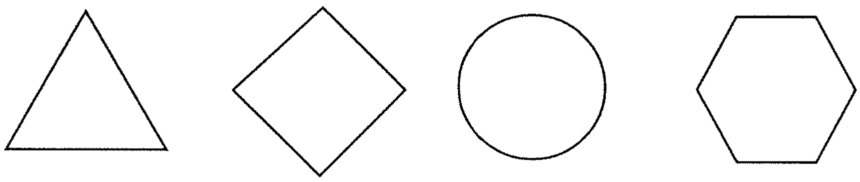
ഇവിടെ ഒരു ചതുരത്തെ 2 തുല്യഭാഗമാക്കുകയാണ് ചെയ്തത്. (1നെ 2 തുല്യ ഭാഗ മാക്കിയതാണ്).

ഇനി നിങ്ങൾക്കിഷ്ടമുള്ള ഒരു ചിത്രം വരച്ച് നേർപകുതിയാക്കി കാണിക്കാമോ ?

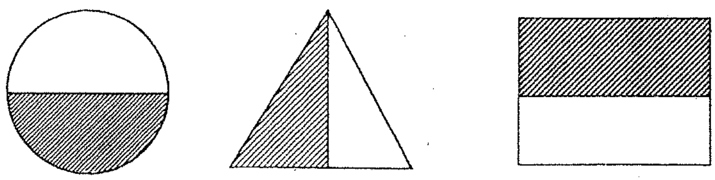
ഇതിൽ നിന്നും നേർപകുതി എന്നത് അര എന്നും പരിചയപ്പെടുത്താം. ഭിന്നസംഖ്യാ രീതിയിൽ $\frac{1}{2}$ എന്നെഴുതാം. (ഒരു വസ്തുവിനെ 2 തുല്യഭാഗമാക്കിയതിൽ ഒന്നാണ് പകുതി) ഇതിനെ അര 'എന്നോ' 'രണ്ടിൽ ഒന്ന്' എന്നോ വായിക്കാം.

വർക്ക്ഷീറ്റ് 1

താഴെ കൊടുത്തിരിക്കുന്ന ചിത്രത്തിൽ $\frac{1}{2}$ ഭാഗത്തിന് നിറം കൊടുക്കുക.



പ്രവർത്തനം



ചിത്രത്തിൽ ഷെയ്ഡ് ചെയ്ത ഭാഗത്തെ സൂചിപ്പിക്കുന്ന ഭിന്നസംഖ്യ എഴുതുക.

ചില കുട്ടികൾ $\frac{2}{1}$ എന്നെഴുതിയിട്ട് ഉണ്ടാവാം.

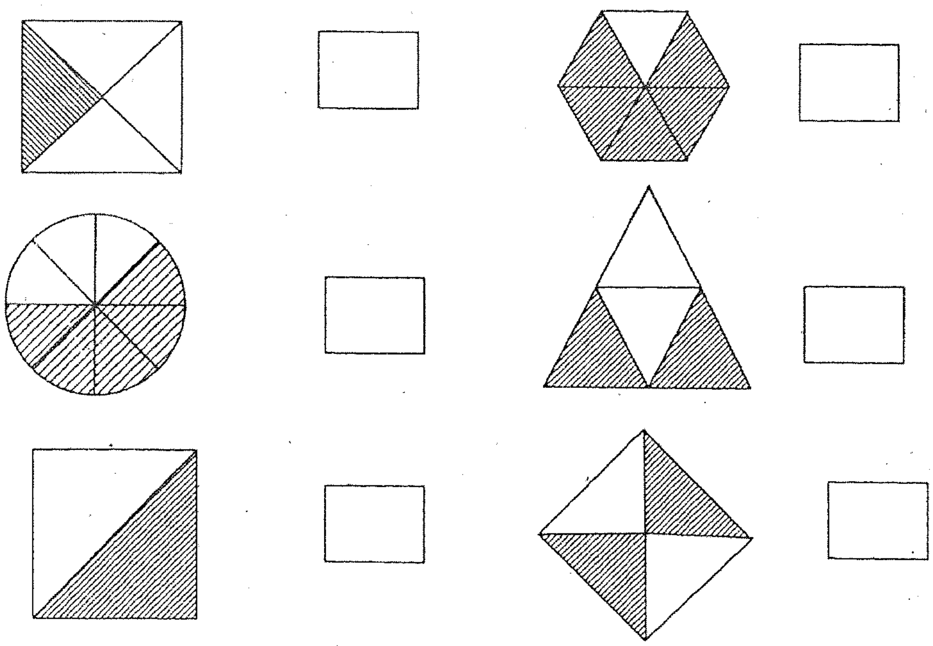
ടീച്ചർക്ക്

(ആകെയുള്ളതിൽ എത്ര എന്നതും ഒന്നിനെ എത്ര തുല്യ ഭാഗങ്ങളാക്കി എന്നതുമാണ് ഭിന്നസംഖ്യരൂപത്തിലെഴുതുന്നത്. ഇതിൽ ഭിന്നസംഖ്യയിൽ വരയുടെ താഴെ എഴുതുന്നത് ആകെ എണ്ണത്തിനെയാണ് സൂചിപ്പിക്കുന്നത്).

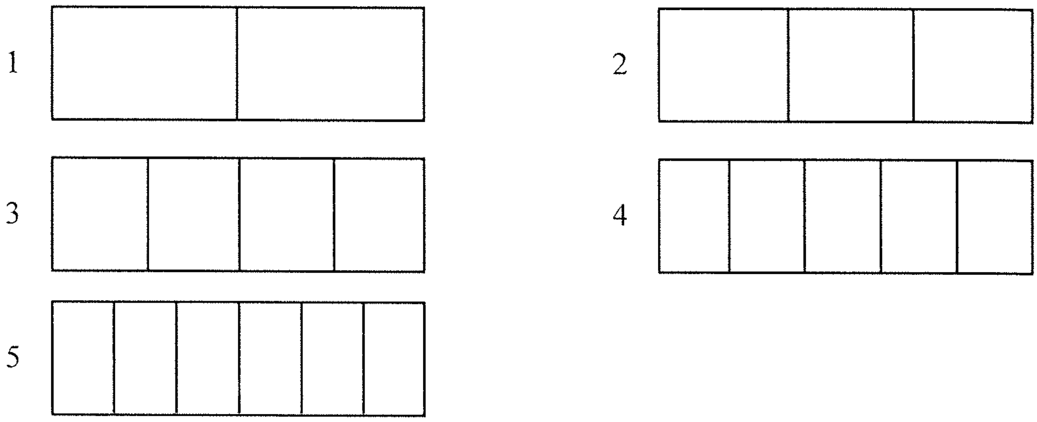
$\frac{1}{2}$ എന്നതിൽ 1 അംശത്തേയും 2 എന്ന ഛേദത്തേയും സൂചിപ്പിക്കുന്നു.

വർക്ക്ഷീറ്റ് 2

ഓരോ ചിത്രത്തിന്റേയും എത്ര ഭാഗമാണ് ഷെയ്ഡ് ചെയ്തിരിക്കുന്നത് ?



പ്രവർത്തനം



തുല്യവലുപ്പമുള്ള ഇത്തരം 5 കടലാസ് സ്ട്രിപ്പുകൾ കുട്ടികൾക്ക് നൽകി അതിന്റെ 1 ഭാഗം മാത്രം കളർ ചെയ്യാനാവശ്യപ്പെടുന്നു. ഇതിന്റെ ഭിന്നസംഖ്യാരൂപം എഴുതുക ?

$\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{5}$, $\frac{1}{6}$ എന്നാണ് എഴുതേണ്ടത്. എന്നാൽ ഏതാനും ചിലർ തിരിച്ചും എഴുതാം. $\frac{3}{1}$ എന്ന രീതിയിൽ എഴുതാം. ആകെ എത്ര തുല്യഭാഗമാക്കി (1 നെ എത്ര കള്ളികളായാണ് ഭാഗിച്ചത്). ഇതാണ് വരയ്ക്ക് താഴെ അല്ലെങ്കിൽ ഛേദമായി വരുന്നത്. ഏറ്റവും ചെറിയ ഭിന്നസംഖ്യ ഏത് എന്ന് പറയാമോ?

താഴെ കൊടുത്തിരിക്കുന്നവയെ ഭിന്നസംഖ്യാരൂപത്തിലെഴുതുക.

1. 4ൽ 1 3. 6ൽ 1
2. 8ൽ 1 4. 10ൽ 1

തുടർന്ന് മുകളിൽ കൊടുത്ത ചിത്രത്തിൽ കളർ ചെയ്ത ഭാഗത്തെ മുറിച്ചെടുത്ത് BBയിൽ പ്രദർശിപ്പിക്കുന്നു. ഇതിൽ ഏറ്റവും കൂടുതൽ ഭാഗം കളർ ചെയ്തത് ഏതാണ് ?

ഇതിൽ നിന്നും $\frac{1}{2}$ ആണ് ഏറ്റവും വലുത് എന്നും $\frac{1}{6}$ ആണ് ഏറ്റവും ചെറുത് എന്നും കണ്ടെത്താം.

ഇതിനെ വലുപ്പക്രമത്തിൽ ക്രമീകരിക്കട്ടെ.

ടീച്ചർക്ക്

ഇതിൽ നിന്നും ഭിന്നസംഖ്യയുടെ വലുപ്പക്രമത്തെക്കുറിച്ചു ധാരണയുണ്ടാക്കുമല്ലോ. $\frac{1}{3}$ എന്നത് 1നെ 3 തുല്യഭാഗമാക്കിയതാണല്ലോ. $\frac{1}{4}$ എന്നത് 1നെ 4 തുല്യഭാഗമാക്കിയതാണ്. ഇതിൽനിന്നും ഏതായിരിക്കും വലുത് എന്ന ധാരണ ബോധ്യപ്പെടുത്തണം.

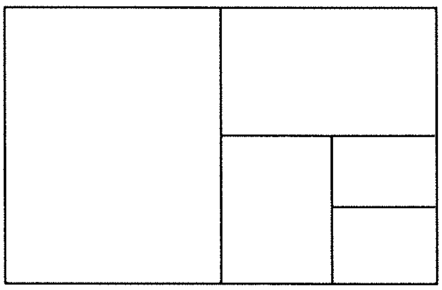
പ്രവർത്തനം

$\frac{2}{8}$, $\frac{2}{10}$, $\frac{2}{4}$, $\frac{2}{12}$, $\frac{2}{6}$ ഇവയെ വലുപ്പക്രമത്തിൽ ക്രമീകരിക്കാമോ ?

ടീച്ചർക്ക്

3 മീറ്ററിനെ 4 തുല്യഭാഗങ്ങളാക്കുമ്പോൾ ഇതിനെ $3 \div 4$ എന്നും $\frac{3}{4}$ എന്നും എഴുതാം. 3നെ 4 തുല്യഭാഗങ്ങളാക്കുക എന്നതിന്റെ അർത്ഥം പകുതിയുടെ പകുതി കണ്ടാൽ മതി അതായത് 3 മീറ്ററിന്റെ പകുതി $1\frac{1}{2}$ മീറ്റർ അതിന്റെ പകുതി 75 സെ.മീ.

വർക്ക്ഷീറ്റ്

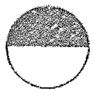
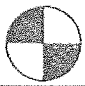
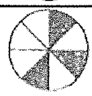
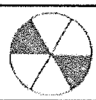
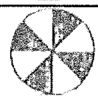


തന്നിട്ടുള്ള മേശവിരിക്ക് കളർ ചെയ്യാൻ ഒരുങ്ങുകയാണ് കൂട്ടുകാർ. അവരെ സഹായിക്കാമോ?

$\frac{1}{2}$ ഭാഗം ചുവപ്പ്, $\frac{1}{4}$ ഭാഗം നീല , $\frac{1}{8}$ ഭാഗം പച്ച , $\frac{1}{16}$ ഭാഗം കറുപ്പ്

വർക്ക്ഷീറ്റ്

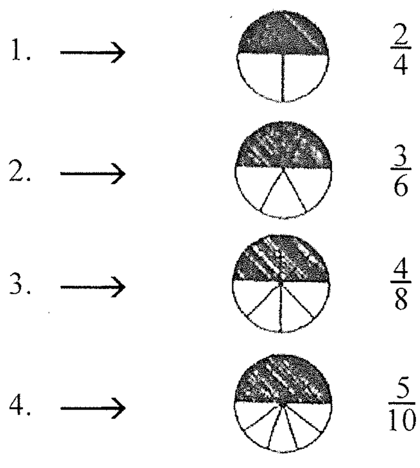
താഴെ കൊടുത്തിരിക്കുന്ന കുട്ടികളുടെ വീട്ടിൽ ഒരേ വലുപ്പമുള്ള കേക്കാണ് ക്രിസ്തുമസിന് മുറിച്ചത്. ഓരോ കുട്ടിക്കും കിട്ടിയ കേക്കിന്റെ ഭാഗം ഷേഡ് ചെയ്തിരിക്കുന്നു. തുല്യ ഭാഗം കേക്ക് കിട്ടിയത് ആർക്കൊക്കെ?

പേര്	കേക്കിന്റെ ഭാഗം	ഭിന്നസംഖ്യ
അപ്പു		
ചിക്കു		
അമ്മു		
ചിന്നു		
കുക്കു		

പ്രവർത്തനം

കുട്ടികളെ 4 ഗ്രൂപ്പുകളാക്കി ഒരേ വലുപ്പമുള്ള നാല് വൃത്തങ്ങൾ നൽകുന്നു. ഒന്നാമത്തെ ഗ്രൂപ്പ് $\frac{2}{4}$ ഭാഗവും രണ്ടാമത്തെ ഗ്രൂപ്പ് $\frac{3}{6}$ ഭാഗവും മൂന്നാമത്തെ ഗ്രൂപ്പ് $\frac{4}{8}$ ഭാഗവും നാലാമത്തെ ഗ്രൂപ്പ് $\frac{5}{10}$ ഭാഗവും ഷെയ്ഡ് ചെയ്യട്ടെ. ഇതിൽ ഏത് ഗ്രൂപ്പ് ഷെയ്ഡ് ചെയ്ത ചിത്രമാണ് വലുതെന്ന് കണ്ടെത്താമോ ?

ഓരോ ഗ്രൂപ്പും ഷെയ്ഡ് ചെയ്യുന്നു. ഷെയ്ഡ് ചെയ്ത ഭാഗം കുട്ടികൾ പ്രദർശിപ്പിക്കട്ടെ. ഇതിനെ തന്നെ ബി.ബി.യിൽ അധ്യാപിക ചിത്രീകരിക്കുന്നു.



ടീച്ചർക്ക്

(ചിത്രങ്ങളും OHP ഷീറ്റും ഉപയോഗിച്ചുകൊണ്ട് പഠനപ്രവർത്തനങ്ങൾ നൽകാം)

ചിത്രം പ്രദർശിപ്പിച്ചപ്പോൾ 4 ഗ്രൂപ്പും ഷെയ്ഡ് ചെയ്തത് ചിത്രത്തിന്റെ നേർപകുതിയാണെന്ന് മനസ്സിലാക്കുന്നു. നേർപകുതിയെ $\frac{1}{2}$ എന്നാണല്ലോ എഴുതാറ്.

നിങ്ങൾ രേഖപ്പെടുത്തിയ ഭിന്നസംഖ്യകളും $\frac{1}{2}$ എന്ന ഭിന്നസംഖ്യയും തമ്മിൽ എന്തെങ്കിലും ബന്ധമുണ്ടോ ? രണ്ടാമത്തെ ചിത്രത്തിൽ $\frac{2}{4}$ എന്നതിന് 4 ഭാഗമാക്കിയതിൽ 2 ഭാഗം (4ന്റെ പകുതിയാണ് 2). ഇതിൽനിന്നും $\frac{1}{2} = \frac{2}{4}$, $\frac{1}{2} = \frac{3}{6}$, $\frac{1}{2} = \frac{4}{8}$, $\frac{1}{2} = \frac{5}{10}$ എന്നു കിട്ടുന്നു. എല്ലാവരും ഷെയ്ഡ് ചെയ്തത് തുല്യമാണെന്ന് കണ്ടെത്തുന്നു. തുടർപ്രവർത്തനമായി $\frac{1}{2}$ ന് തുല്യമായ മറ്റു ഭിന്നസംഖ്യകൾ കുട്ടികൾ എഴുതട്ടെ.

ടീച്ചർക്ക്

ഇവിടെയെഴുതിയ ഭിന്നസംഖ്യകളെല്ലാം പകുതിക്ക് തുല്യമാണെന്ന ധാരണ ബോധ്യപ്പെടുത്തുന്നതിനോടൊപ്പം തുല്യഭിന്നം കണ്ടെത്തുന്ന രീതിയും കൂടി പരിചയപ്പെടുത്തിക്കൂടെ? (അംശത്തേയും ഛേദത്തേയും ഒരേ സംഖ്യകൊണ്ട് ഗുണിക്കുന്നു).

$\frac{1}{4}$ ന് തുല്യമായ ഭിന്നങ്ങളും എഴുതാൻ അവസരം നൽകുന്നു.

പ്രവർത്തനം

താഴെ തന്നിരിക്കുന്ന ഭിന്നസംഖ്യകൾക്ക് തുല്യമായ ഭിന്നങ്ങൾ എഴുതുക.

1) $\frac{2}{5} =$ 2) $\frac{3}{6} =$

2) $\frac{4}{8} = \frac{-}{40}$ 4) $\frac{2}{6} = \frac{10}{-}$

5) $\frac{10}{20} = \frac{5}{-}$ 6) $\frac{6}{12} = \frac{-}{-}$

വർക്ക്ഷീറ്റ്

തരംതിരിക്കാം

താഴെ കൊടുത്തിരിക്കുന്ന ഭിന്നസംഖ്യകളെ $\frac{1}{2}$നേക്കാൾ വലുത് $\frac{1}{2}$ നേക്കാൾ ചെറുത് എന്നിങ്ങനെ തരംതിരിക്കുക.

$\boxed{\frac{3}{4}}$

$\boxed{\frac{2}{3}}$ $\boxed{\frac{3}{4}}$

$\boxed{\frac{1}{3}}$ $\boxed{\frac{2}{5}}$ $\boxed{\frac{3}{5}}$ $\boxed{\frac{4}{5}}$

$\boxed{\frac{2}{4}}$ $\boxed{\frac{2}{6}}$ $\boxed{\frac{3}{6}}$ $\boxed{\frac{1}{5}}$

$\boxed{\frac{1}{6}}$ $\boxed{\frac{4}{6}}$ $\boxed{\frac{5}{6}}$

$\frac{1}{2}$ നേക്കാൾ വലുത്	$\frac{1}{2}$ നേക്കാൾ ചെറുത്

രണ്ട് കൂട്ടത്തിലും പെടാത്തവയുണ്ടോ?

പ്രവർത്തനം 4

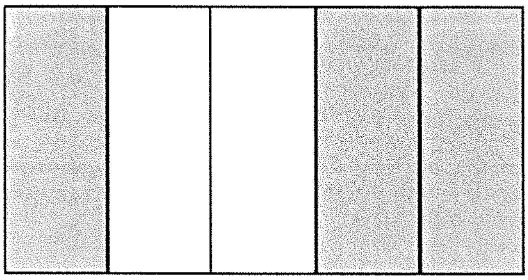
രാജു തന്റെ സ്ഥലത്ത് പച്ചക്കറി കൃഷിചെയ്യാൻ തീരുമാനിച്ചു. സ്ഥലത്തെ 5 തുല്യ ഭാഗമാക്കി അതിൽ 1 ഭാഗം ചീരയും 2 ഭാഗം പാവയ്ക്കയും കൃഷിചെയ്തു. ആകെ എത്ര ഭാഗമാണ് കൃഷി ചെയ്തത്?

ചീരകൃഷി ചെയ്തത് എത്ര ഭാഗമാണ് ? $\frac{1}{5}$ ഭാഗം

പാവയ്ക്ക കൃഷി ചെയ്തതോ? $\frac{2}{5}$ ഭാഗം

എന്നാൽ ആകെ എത്ര ഭാഗമാണ് കൃഷി ചെയ്തത് ? $\frac{1}{5} + \frac{2}{5}$ എത്രയാണ് ?

അധ്യാപിക B.Bയിൽ ചിത്രം വരച്ചു കാണിക്കുന്നു.



ആകെ ഷെയ്ഡ് ചെയ്ത ഭാഗം - 3

ആകെയുള്ളതിൽ എത്ര ? $\frac{3}{5}$ ഭാഗം

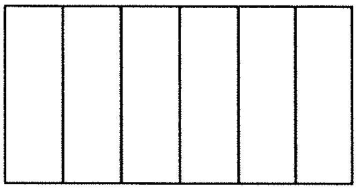
ഇതിൽനിന്നും $\frac{1}{5} + \frac{2}{5} = \frac{3}{5}$ എന്ന ധാരണ കുട്ടികൾക്കുണ്ടാവുന്നു.

$\frac{1}{5} + \frac{2}{5} = \frac{3}{10}$ ഇങ്ങനെ ഒരു കുട്ടി എഴുതിയാൽ എങ്ങനെ പരിഹരിക്കാം ?

$\frac{2}{5} = \frac{4}{10}$ എന്ന് കുട്ടികൾക്കറിയാം. $\frac{1}{5}$ കൂട്ടിയാൽ $\frac{4}{10}$ നേക്കാൾ വലിയ സംഖ്യ ലഭിക്കണം.

രാജു തന്റെ സ്ഥലത്തിനെ എത്രയായാണ് വീതിച്ചത് ? 5 ഭാഗം. അതിൽ തന്നെയുള്ള ഒരു ഭാഗത്താണ് ചീരകൃഷി ചെയ്തതെന്നും മറ്റ് രണ്ട് ഭാഗത്താണ് പാവയ്ക്ക കൃഷിചെയ്തതെന്നും പരിചയപ്പെടുത്താം. ചിത്രത്തിന്റേയും OHP ഷീറ്റിന്റേയും സഹായത്തോടെ ഇത് ബോധ്യപ്പെടുത്താവുന്നതാണ്.

തന്നിട്ടുള്ള ചിത്രത്തിൽ $\frac{2}{6}$ ഭാഗം നീലപെയിന്റും $\frac{1}{6}$ ഭാഗം ചുവപ്പും $\frac{2}{6}$ ഭാഗം പച്ചയും അടിക്കുക. ആകെ എത്ര ഭാഗം പെയിന്റ് ചെയ്തു ?



മൊഡ്യൂൾ - II

ഭാഗങ്ങളുടെ സംഖ്യ

'ഭാഗങ്ങളുടെ സംഖ്യ' എന്ന മൊഡ്യൂൾ പഠിക്കുന്നതിലൂടെ നിങ്ങൾക്ക് താഴെ പറയുന്ന ഉദ്ദേശ്യങ്ങൾ നേടാൻ കഴിയും.

1. ഭിന്നസംഖ്യ എന്ന ആശയം അറിയുന്നതിന്.
2. ഒരു നിശ്ചിത എണ്ണത്തെ പകുതിയാക്കേണ്ട സന്ദർഭം അറിയുന്നതിന്.
3. നിശ്ചിത ആകൃതിയിലുള്ള വസ്തുക്കളെ പകുതിയാക്കുന്നതിനുള്ള അറിവ് നേടുന്നതിന്.
4. $\frac{1}{4}$, $\frac{3}{4}$ എന്നീ ആശയങ്ങൾ നേടുന്നതിന്.
5. ഒരു ഭിന്നസംഖ്യയുടെ പല രൂപങ്ങളെ തിരിച്ചറിയുന്നതിന്.
6. ഭിന്നസംഖ്യകൾ തമ്മിലുള്ള താരതമ്യം, പരസ്പരബന്ധം, വ്യാഖ്യാനം, ഊഹിക്കൽ എന്നിവ വിശദീകരിക്കാൻ കഴിയുന്നതിന്.

മൊഡ്യൂൾ ഫ്രെയിം

ആശയങ്ങൾ	പഠനബോധന പ്രക്രിയ	പഠനനേട്ടങ്ങൾ
• ഭിന്നസംഖ്യ ഉപയോഗിക്കേണ്ടിവരുന്ന നിരവധി സന്ദർഭങ്ങളുണ്ട്. • ഒരു നിശ്ചിത എണ്ണം വസ്തുക്കളെ പകുതിയാക്കേണ്ട സന്ദർഭമുണ്ട്.	• നിത്യജീവിതവുമായി ബന്ധപ്പെട്ട് എണ്ണുമ്പോഴും അളക്കുമ്പോഴും വരാവുന്ന ബാക്കിവരുന്ന ഭാഗത്തിന്റെ സംഖ്യ - സന്ദർഭങ്ങൾ, വിശകലനം, ബോധ്യപ്പെടൽ, പരസ്പരബന്ധം, പ്രശ്നപരിഹരണം എന്നിവ നടത്തുന്നു.	ഒരു വസ്തുവിനെ / നിശ്ചിത എണ്ണം വസ്തുക്കളെ പകുതിയാക്കുന്ന രീതി വിശദീകരിക്കുന്നു.
• നിശ്ചിത ആകൃതിയിലുള്ള വസ്തുക്കളെ പകുതിയാക്കുന്നതിന് വ്യത്യസ്ത രീതികളുണ്ട്.	• ചില ജ്യാമിതീയ രൂപങ്ങളും, മറ്റു നിശ്ചിത രൂപങ്ങളും പകുതിയാക്കുന്നതിനുള്ള പ്രവർത്തനം (ചതുരം, വട്ടം...)	$\frac{1}{2}$ ഭാഗം തിരിച്ചറിയുന്നു.
• ഒരു വസ്തുവിനെ / ഒരു നിശ്ചിത രൂപത്തെ 2 തുല്യ ഭാഗങ്ങളാക്കിയാൽ ഓരോ ഭാഗത്തേയും അതിന്റെ രണ്ടിലൊന്ന് എന്ന് പറയുന്നു.	• വിവിധ രൂപങ്ങളെ $\frac{1}{2}$ ആയി ഭാഗിക്കാനും നിറം നൽകാനുമുള്ള പ്രവർത്തനങ്ങൾ.	$\frac{1}{2}$ ആയി ഭാഗിക്കുന്നു.
• ഒരു നിശ്ചിത രൂപത്തെ നാല് തുല്യഭാഗങ്ങളാക്കിയതിൽ ഒരു ഭാഗമാണ് നാലിലൊന്ന് അഥവാ $\frac{1}{4}$	• നിത്യജീവിതത്തിൽ സ്ഥലത്തെ 4 തുല്യ ഭാഗങ്ങളുമായി ബന്ധപ്പെട്ട പ്രശ്നം വിശകലനം ചെയ്യുന്നു. നിർദ്ധാരണം ചെയ്യുന്നു.	വിവിധ രൂപങ്ങളെ $\frac{1}{4}$ ആയി ഭാഗിക്കുന്നു.
• നാല് തുല്യഭാഗങ്ങളാക്കിയതിൽ മൂന്ന് ഭാഗങ്ങളെ നാലിൽ മൂന്ന് എന്നു പറയുന്നു.	• നിത്യജീവിതത്തിൽ ഒരു സ്ഥലത്തെ 4 തുല്യഭാഗങ്ങളാക്കുന്നതുമായി ബന്ധപ്പെട്ട പ്രശ്നവിശകലനം ചെയ്യുന്നു. നിർധാരണം ചെയ്യുന്നു.	വിവിധ രൂപങ്ങളെയും മറ്റും ഭാഗിച്ചതിൽ നിന്നും $\frac{1}{2}$, $\frac{1}{4}$, $\frac{3}{4}$ എന്നിവ കണ്ടെത്തുന്നു. യുക്തി വിശദീകരിക്കുന്നു.
• ഇതിനെ $\frac{3}{4}$ എന്നെഴുതുകയും നാലിൽ മൂന്ന് എന്ന് വായിക്കുകയും ചെയ്യുന്നു.	• നിത്യജീവിതത്തിൽ നാല് തുല്യഭാഗങ്ങളാക്കേണ്ട സന്ദർഭങ്ങൾ അവതരിപ്പിക്കുന്നു.	
• $\frac{3}{4}$ എന്നെഴുതുകയും നാലിൽ മൂന്ന് എന്ന് വായിക്കുകയും ചെയ്യുന്നു.	• കാൽ, അര, മുക്കാൽ എന്നീ ഭാഗങ്ങളെ തിരിച്ചറിയുന്നതിനുള്ള പ്രായോഗിക സന്ദർഭങ്ങൾ.	

ആശയങ്ങൾ	പഠനബോധന പ്രക്രിയ	പഠനനേട്ടങ്ങൾ
• ഒരു ഭിന്നസംഖ്യയിലെ അതിന് തുല്യമായ മറ്റു ഭിന്ന സംഖ്യാരൂപങ്ങളിൽ എഴുതാം. • ഭിന്നസംഖ്യയെ ഹരണക്രിയയായും ഹരണക്രിയയെ ഭിന്നസംഖ്യയായും വ്യാഖ്യാനിക്കാം.	• ഒരു ഭിന്നസംഖ്യയെ അതിന് തുല്യമായ മറ്റു ഭിന്നസംഖ്യാരൂപത്തിൽ എഴുതുന്ന പ്രവർത്തനം. • ഒരു കൂട്ടം വസ്തുക്കളെ തുല്യഭാഗങ്ങളാക്കി ഭാഗം വെയ്ക്കുന്നതിലൂടെ ഭിന്നസംഖ്യകൾ രൂപംകൊള്ളുന്ന പ്രവർത്തനം. • ICT ഉപയോഗിച്ച് ഭിന്നസംഖ്യകളെ രൂപീകരിക്കുകയും അവയെ വിശദീകരിക്കുകയും ചെയ്യുന്ന പ്രവർത്തനം.	• ഹരണരൂപത്തിലുള്ള ക്രിയകളെ ഭിന്നരൂപത്തിൽ എഴുതാനും പറയാനും കഴിയുന്നു. • ശിഷ്ടം വരുന്ന ഹരണ സന്ദർഭങ്ങളിൽ ഹരണഫലം ഭിന്നസംഖ്യാരൂപത്തിൽ പറയാനും എഴുതാനും കഴിയുന്നു.

രീതിശാസ്ത്രം

ഭിന്നസംഖ്യകളെ അവതരിപ്പിക്കുന്നതിന് നിങ്ങൾക്ക് താഴെപറയുന്ന രീതികൾ തെരഞ്ഞെടുക്കാം. പഠനനേട്ടങ്ങൾ ഫലപ്രദമായി കുട്ടികളിൽ വിനിമയം ചെയ്യാനുതകുന്നതായിരിക്കണം പഠനരീതി.

1. ആഗമന - നിഗമന രീതി
2. പരീക്ഷണ രീതി
3. ഗവേഷണ രീതി

കുട്ടികൾക്ക് ഉണ്ടായിരിക്കേണ്ട മുന്നറിവ്

ഭിന്നസംഖ്യകളെക്കുറിച്ച് പഠിക്കുന്നതിന് കുട്ടികൾക്ക് താഴെപറയുന്ന ആശയങ്ങളെക്കുറിച്ച് മുന്നറിവുണ്ടായിരിക്കണം.

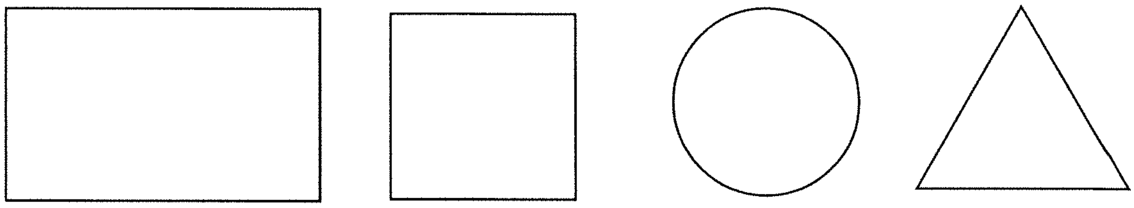
1. **പൂർണ്ണ സംഖ്യകൾ (Integers)**

   പോസിറ്റീവ് പൂർണ്ണസംഖ്യകളും (1, 2, 3, 4, 5 .....)
   പൂജ്യവും നെഗറ്റീവ് പൂർണ്ണസംഖ്യകളും (-1, -2, -3, ...)
   ഉൾപ്പെട്ട സംഖ്യാഗണമാണ് പൂർണ്ണസംഖ്യകൾ.

2. ഇവിടെ പോസിറ്റീവ് പൂർണ്ണസംഖ്യകളാണ് പരിഗണിക്കുന്നത്.

   ഉദാ: പൂർണ്ണസംഖ്യ തെരഞ്ഞെടുത്തെഴുതുക.
   5.5, 2.3, 2.7, 3, 14.2
   മേൽകൊടുത്തവയിൽ 3 ആണ് പൂർണ്ണസംഖ്യ.

2. വിവിധ ജ്യാമിതീയ രൂപങ്ങൾ



ചതുരം സമചതുരം വൃത്തം ത്രികോണം

3. സംഖ്യകൾ തമ്മിലുള്ള ഹരണക്രിയ

ഉദാ: (1) 8നെ 4 കൊണ്ട് ഹരിക്കുമ്പോൾ 8ൽ നാല് എത്ര പ്രാവശ്യം എന്ന രീതിയിൽ $\frac{8}{4}$ എന്ന് എഴുതുന്നു. അതായത് 8നെ നാലിന്റെ എത്ര കൂട്ടങ്ങളാക്കാം ? രണ്ട്. അതായത് $\frac{8}{4} = 2$ എന്ന് ലഭിക്കുന്നു.

(2) 2നെ 3 കൊണ്ട് ഹരിക്കുമ്പോൾ അത് ഭിന്നരൂപത്തിൽ $\frac{2}{3}$ എന്നെഴുതാം.

4. അളക്കുന്നതിനുള്ള കഴിവ്

നീളം, കോൺ എന്നിവ അളക്കുന്നതിന് യഥാക്രമം സ്കെയിൽ, പ്രൊട്രാക്ടർ എന്നിവ ഉപയോഗിക്കാവുന്നതാണ്.

വേണ്ട പഠനബോധന സാമഗ്രികൾ

വിവിധ ബോധനപ്രക്രിയകൾക്കാവശ്യമായ പഠനസാമഗ്രികൾ അനുയോജ്യമായവ തെരഞ്ഞെടുത്ത് ഉപയോഗിക്കണം. താഴെ പറയുന്ന പഠന-ബോധന സാമഗ്രികൾ ആവശ്യമായ സന്ദർഭങ്ങളിൽ എടുത്തുപയോഗിക്കാവുന്നതാണ്.

1. ഫ്രാക്ഷൻ ഡിസ്ക് കിറ്റ്
2. നൂൽ, റിബണുകൾ, സ്കെയിൽ, പ്രൊട്രാക്ടർ
3. വിവിധ രൂപങ്ങൾ അടങ്ങിയ പേപ്പർ കട്ടിംഗ്സ്
4. ചാർട്ടുകൾ, വിവിധ കളർ പെൻസിലുകളടങ്ങിയ കിറ്റ്

ഐ.സി.ടി. വിഭവങ്ങൾ

1. P.h.ET - Ubuntu O/S, Application ICT resources PhET
2. J fraction Lab - Application → Education → Jfraction lab
3. Geogebra - Application → Education → Geogebra
4. ICT resources - Application → ICT Resources → Std. V

- മേൽപറഞ്ഞ ICT വിഭവങ്ങളെല്ലാം സ്കൂളുകളിൽ ICT പഠനത്തിനുപയോഗിക്കുന്ന Ubuntu O/Sൽ ലഭ്യമാണ്.

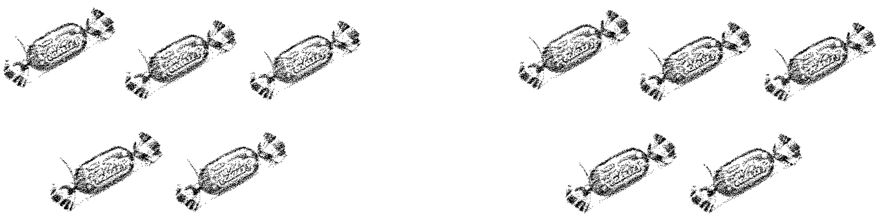
പഠനപ്രവർത്തനങ്ങൾ

1. പകുതിയാക്കാം

അനുവും വിനുവും ഇരട്ടകുട്ടികളാണ്. പിറന്നാളിനോടനുബന്ധിച്ച് അച്ഛൻ അവർക്ക് 10 മിഠായികളടങ്ങിയ ഒരു പാക്കറ്റും, ചതുരാകൃതിയിലുള്ളതും വൃത്താകൃതിയിലുമുള്ള രണ്ട് കേക്കുകളും സമ്മാനമായി നൽകി. അനുവിനോടും വിനുവിനോടും സമ്മാനങ്ങളെല്ലാം തുല്യമായി വീതിക്കാൻ ആവശ്യപ്പെടുകയും ചെയ്തു.

അനുവും വിനുവും, അവർക്ക് കിട്ടിയ മിഠായികൾ വീതംവെച്ചു.

അനു, അച്ഛൻ നൽകിയ 10 മിഠായികൾ തുല്യമായി വേർതിരിച്ചു. അത് ഇപ്രകാരമായിരുന്നു.



ശരിയല്ലേ? വിനു സമ്മതിച്ചു. അങ്ങനെ ഓരോരുത്തർക്കും 5 മിഠായി വീതം ലഭിച്ചു. അനു പറഞ്ഞു; 'നിനക്ക് ഞാൻ ആകെയുള്ളതിന്റെ രണ്ടിലൊന്ന് തന്നിരിക്കുന്നു.'

അതെ, പക്ഷേ അതിന് ആകെയുള്ളതിന്റെ പകുതി തന്നു എന്ന് പറഞ്ഞാൽ പോരേ...?

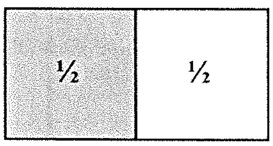
അപ്പോഴാണ് അച്ഛൻ അവരുടെ അടുത്തേക്ക് വന്നത്. തർക്കിക്കേണ്ട. ആകെയുള്ളവയെ രണ്ട് തുല്യഭാഗമാക്കിയതിൽ ഒരു ഭാഗമാണ്. ½ അഥവാ പകുതി. മനസ്സിലായല്ലോ?

O.K അനുവിനും വിനുവിനും തൃപ്തിയായി.

തുടർന്ന് ഇരുവരും ചതുരാകൃതിയിലുള്ളതും വൃത്താകൃതിയിലുള്ളതുമായ കേക്ക് വിഭജിക്കാൻ തീരുമാനിച്ചു.

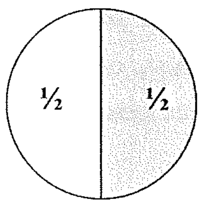
ആദ്യം ചതുരകേക്ക് എടുത്തു. എങ്ങനെ മുറിക്കും?

ഉം... വഴിയുണ്ട്... ഞാൻ ഇതിന്റെ നീളമൊന്ന് അളക്കാം. വിനുവാണ് അതിന് തുടക്കമിട്ടത്. അപ്രകാരം നീളമളന്ന് കേക്ക് മുറിച്ചു.



അതിലൊരു ഭാഗം മിനു അനുവിന് നൽകി. അപ്പോൾ പകുതി ഇങ്ങനെയും ആക്കാമല്ലേ?... അനു പറഞ്ഞു.

ഇനി വൃത്താകൃതിയിലുള്ള കേക്ക് ഇതേപോലെ മുറിക്കാനുള്ള ആവേശത്തിലാണ് അനു. കേക്കിന് തീരെ കട്ടിയുമില്ലായിരുന്നു. കേക്കിന്റെ കേന്ദ്രം നോക്കി അനു രണ്ടായി കേക്കിനെ മുറിച്ചു.



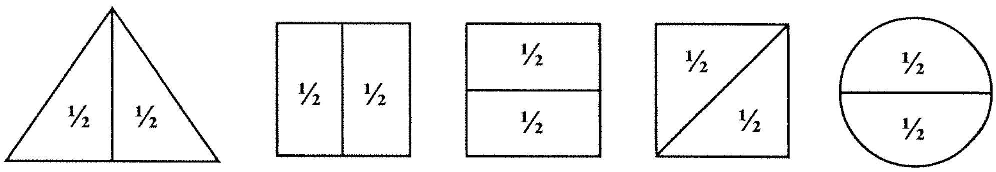
ഓഹോ... ഇതും നേർപകുതി ആയല്ലോ. വിനു പറഞ്ഞു. ഒരു കഷണം നിനക്കും, മറ്റേ കഷണം എനിക്കും. അനു ഭാഗിച്ചു. അപ്പോൾ രണ്ടിലൊരു കഷണം അനുവിനും, മറ്റേ കഷണം വിനുവിനും കിട്ടി.

അങ്ങനെ പകുതി രണ്ടാൾക്കും കിട്ടി. അച്ഛൻ ഇടപെട്ടു.

<u>ക്രോഡീകരണം</u>

- ഒരു നിശ്ചിത എണ്ണം വസ്തുക്കളെ തുല്യമായി ഭാഗിക്കുന്നതെങ്ങനെയെന്ന് വസ്തുക്കളെ രണ്ട് തുല്യ എണ്ണമാക്കിയ ശേഷം, അതിൽ ഒരു ഭാഗമാണ് രണ്ടിലൊന്ന് എന്നും, അത് പകുതി എന്നും മനസ്സിലാക്കണം.
- പകുതിയെ അര എന്നും, സംഖ്യാരൂപത്തിൽ ½ എന്നും സൂചിപ്പിക്കാറുണ്ട്.
- ചതുരാകൃതിയിലും വൃത്താകൃതിയിലുള്ളതുമായ രൂപങ്ങളെ കൃത്യമായി എങ്ങനെയാണ് പകുതിയാക്കേണ്ടതെന്നും, പകുതിയാക്കാൻ വ്യത്യസ്തമാർഗ്ഗങ്ങളുണ്ടെന്നും തിരിച്ചറിയണം.

  eg:-

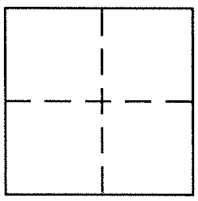


- ടെക്സ്റ്റ് ബുക്ക് പേജ് 121 ലെ എത്ര ഭാഗം എന്ന പ്രവർത്തനം ക്ലാസ്സിൽ ചെയ്യിക്കണം.
  വിലയിരുത്തൽ : താരതമ്യം, സമർത്ഥനം, പൊരുത്തപ്പെടൽ.
- TB Page 122ലെ ചതുരത്തിൽ പകുതി, മിഠായി പങ്കുവെയ്ക്കാം എന്നീ പഠനപ്രവർത്തനങ്ങളും കൂടി ക്ലാസ്സിൽ കൊടുക്കാവുന്നതാണ്.

  വിലയിരുത്തൽ : പകുതി എന്ന ആശയം, കൃത്യത, സൂക്ഷ്മത.
- കൂടാതെ 1 മീറ്ററിന്റെ പകുതി ½ മീറ്റർ, 1 ലിറ്ററിന്റെ പകുതി ½ ലിറ്റർ എന്ന ആശയവും അവതരിപ്പിക്കണം. (TB Page No. 63 Std. V)

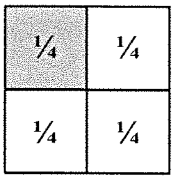
2. വീണ്ടും ഭാഗിച്ചപ്പോൾ

ആയിടയ്ക്കാണ് അനുവിന്റെയും വിനുവിന്റെയും അമ്മാവൻ ഗൾഫിൽ നിന്ന് വന്നത്. പിറന്നാൾ സമ്മാനമായി താഴെ കുടൊത്തിരിക്കുന്ന തരത്തിലുള്ള ഒരു ചോക്ലേററാണ് അവർക്ക് കിട്ടിയത്.



രണ്ടുപേരും കൂടി ചോക്ലേറ്റ് രണ്ട് തുല്യഭാഗമാക്കാൻ ശ്രമിക്കുകയാണ്. അപ്പോഴാണ് കൂട്ടുകാരായ ബാബുവും സുനിലും കൂടി അവരുടെ അടുത്തേയ്ക്ക് വന്നത്.

ചോക്ലേറ്റ് അവർക്കുകൂടി നൽകുവാൻ അനുവും സുനുവും തീരുമാനിച്ചു. അങ്ങനെയെങ്കിൽ ചോക്ലേറ്റിനെ നാല് തുല്യഭാഗങ്ങളാക്കാം. അപ്രകാരം ഓരോരുത്തർക്കും 4ൽ ഓരോ ഭാഗം കിട്ടി.



നാലിൽ ഒരു ഭാഗത്തെ കാൽ എന്ന് പറയാം. ബാബു അഭിപ്രായപ്പെട്ടു.

അതെ, 'കാൽ' എന്നതിനെ ¼ എന്ന് സംഖ്യാപരമായി സൂചിപ്പിക്കാമല്ലോ. സുനിൽ കൂട്ടിച്ചേർത്തു.

നാലു പേർ കൂടി വീണ്ടും ചർച്ചയായി.

അനുവിനും വിനുവിനും കൂടി എത്ര ഭാഗം വീതം ചെയ്തു കിട്ടി?

അനുവിന് കിട്ടിയത്; $\frac{1}{4}$

വിനുവിന് കിട്ടിയത്; $\frac{1}{4}$

രണ്ടുപേർക്കും കൂടി ആകെ എത്ര ഭാഗം ചോക്ലേറ്റ് കിട്ടി ?

രണ്ട്, $\frac{1}{4}$ ഭാഗവും കൂടി ചേർത്തുവെച്ച് നോക്കൂ. ബാബു ആവശ്യപ്പെട്ടു.

അപ്പോൾ മൊത്തം ചോക്ലേറ്റിന്റെ പകുതി ഭാഗം കിട്ടി. അനു മറുപടി പറഞ്ഞു.

അതായത്, രണ്ട്, നാലിലൊരു ഭാഗം ചേർന്നപ്പോൾ ആകെ ചോക്ലേറ്റിന്റെ പകുതി കിട്ടി.

എങ്കിൽ $\frac{1}{4}$ ഉം $\frac{1}{4}$ ഉം ചേർന്നാൽ എത്ര ലഭിക്കും? $\frac{1}{2}$

അതായത്, $\frac{1}{4} + \frac{1}{4} = \frac{2}{4} = \frac{1}{2}$ എന്ന് ലഭിക്കും. ബാബു വിശദീകരിച്ചു.

ഇനി ബാബുവിനും, സുനിലിനും കൂടി കിട്ടിയ ചോക്ലേറ്റിന്റെ ഭാഗങ്ങൾ ചേർത്തു നോക്കിയാലോ?

അതും $\frac{1}{4} + \frac{1}{4} = \frac{2}{4} = \frac{1}{2}$ അതായത്, അത് ആകെ ചോക്ലേറ്റിന്റെ പകുതിയാവും.

അപ്പോൾ നാല് പേർക്കും ലഭിച്ച ചോക്ലേറ്റിന്റെ ഭാഗങ്ങൾ കൂടിചേർത്താൽ ഒരു മുഴുവൻ ചോക്ലേറ്റ് ആകും.

അതായത്, $\frac{1}{4} + \frac{1}{4} + \frac{1}{4} + \frac{1}{4}$

$$= \frac{2}{4} + \frac{2}{4} = \frac{4}{4} = 1$$

അങ്ങനെയെങ്കിൽ, ഒരു നിശ്ചിത രൂപത്തെ 4 തുല്യഭാഗങ്ങളാക്കിയെങ്കിൽ ഒരു ഭാഗത്ത് നാലിലൊന്ന്. അഥവാ $\frac{1}{4}$

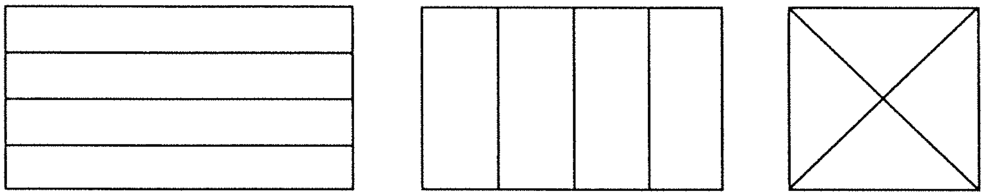
ക്രോഡീകരണം

1. ഒരു നിശ്ചിത എണ്ണം വസ്തുക്കളെ നാല് തുല്യ എണ്ണങ്ങളുടെ കൂട്ടമാക്കിയതിൽ ഒരു കൂട്ടമായിരിക്കും നാലിൽ ഒന്ന്.

2. ഒരു നിശ്ചിത രൂപത്തെ നാല് തുല്യ ഭാഗങ്ങളാക്കിയതിൽ ഒരു ഭാഗമായിരിക്കും നാലിലൊന്ന് അഥവാ $\frac{1}{4}$

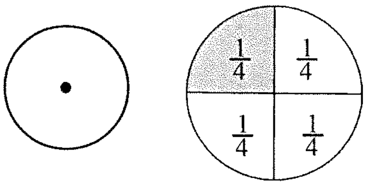
3. $\frac{1}{4}$ നെ 'കാൽ' എന്നും സൂചിപ്പിക്കാറുണ്ട്.

4. വ്യത്യസ്ത രീതിയിൽ രൂപങ്ങളെ നാലിലൊന്നായി മാറ്റാം.



5. T.B. Page No. 125ലെ നിറം നൽകിയ ഭാഗം വരച്ച് നിറം നൽകാം എന്ന പ്രവർത്തനം ക്ലാസ്സിൽ കുട്ടികൾക്ക് നൽകാം.

6. Fraction Disc ഉപയോഗിച്ച് $\frac{1}{4}$ എന്ന ആശയം ക്ലാസ്സിൽ അവതരിപ്പിക്കാം.



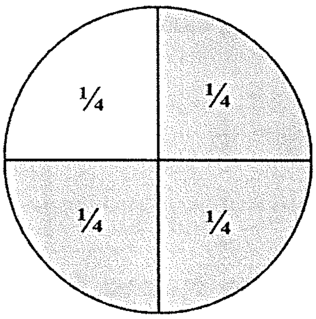
7. J Fraction Lab ഉപയോഗിച്ച് മേൽ സൂചിപ്പിച്ച ആശയം ICT സങ്കേതമുപയോഗിച്ച് ചിത്രീകരിക്കാം.

(Application → Education → J - Fraction lab → Clicking the Nr.)

3. വിളവെടുപ്പ്

അനുവിന്റെയും വിനുവിന്റെയും പച്ചക്കറിത്തോട്ടത്തിൽ ഒരു വലിയ മത്തങ്ങ ഉണ്ടായി. മത്തങ്ങ വിളവെടുത്തു. അവർ മത്തങ്ങ നാല് തുല്യഭാഗങ്ങളാക്കി. ഒരു ഭാഗം കറിവെയ്ക്കാൻ ഉപയോഗിച്ചു. ബാക്കി ഭാഗങ്ങൾ അനുവും വിനുവും ബാബുവും കൂടി എടുത്തു.

ഇവിടെ അനുവിനും വിനുവിനും ബാബുവിനും കൂടി എത്ര ഭാഗം മത്തങ്ങ കിട്ടി?



നാല് ഭാഗമാക്കിയതിൽ 3 ഭാഗം അല്ലേ?

അതായത് $\frac{3}{4}$ ഭാഗം

ഇനി ഓരോരുത്തർക്കും കിട്ടിയ ഭാഗങ്ങൾ ചേർത്ത് വെച്ചാലോ?

$$\frac{1}{4} + \frac{1}{4} + \frac{1}{4} = \frac{1}{2} + \frac{1}{4}$$

= അര + കാൽ

= മുക്കാൽ

മുക്കാലിനെ 4ൽ മൂന്ന് എന്നും പറയാം.

അതായത് മുക്കാൽ = $\frac{3}{4}$

താഴെ പറയുന്ന രീതികളിലും ഇതിനെ വ്യാഖ്യാനിക്കാം.

(1) $\frac{1}{4} + \frac{1}{4} + \frac{1}{4} = \frac{(1+1+1)}{4} = \frac{3}{4}$

(2) $\frac{1}{4} + \frac{1}{4} + \frac{1}{4}$, $3 \times \frac{1}{4} = \frac{3}{4}$

(3) 3 കാലുകൾ ചേർന്നാൽ മുക്കാൽ.

(4) മുഴുവൻ ഭാഗത്തിൽനിന്നും കാൽ ഭാഗം കുറച്ചാൽ മുക്കാൽ കിട്ടും.

അതായത്, $1 - \frac{1}{4} = \frac{3}{4}$

(5) $\frac{1}{4} + \frac{1}{4} + \frac{1}{4} = \frac{2}{4} + \frac{1}{4} = \frac{3}{4}$

(6) $\frac{1}{4} + \frac{1}{4} + \frac{1}{4} = \frac{2}{4} + \frac{1}{4} = \frac{1}{2} \times \frac{1}{4}$

$$= \frac{(1 \times 4) + (2 \times 1)}{2 \times 4} = \frac{4+2}{8}$$

$$= \frac{6}{8} = \frac{3}{4}$$

ഇപ്രകാരം $\frac{3}{4}$ നെ വ്യാഖ്യാനിക്കാമെന്ന് മനസ്സിലാക്കണം.

ക്രോഡീകരണം

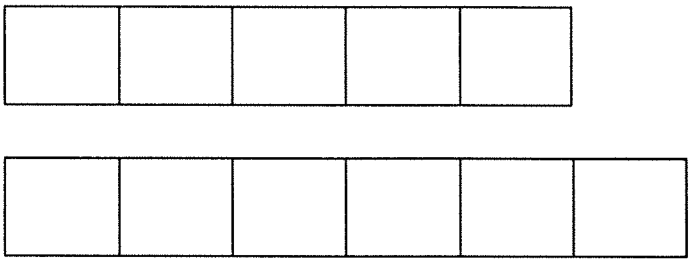
- ഒരു നിശ്ചിതരൂപത്തെ 4 തുല്യഭാഗങ്ങളാക്കിയതിൽ 3 ഭാഗമാണ് മുക്കാൽ അഥവാ $\frac{3}{4}$
- Text Book Page No. 68 ലെ ഭാഗം പലതരം എന്ന പ്രവർത്തനം (Std. 5).
- Text Book Page No. 126 ലെ നിറം നൽകിയത് എന്ന പഠനപ്രവർത്തനം (Std.4). ഇവ പരിഗണിക്കുക.

വിലയിരുത്തൽ

- **നിഗമന രൂപീകരണം എന്ന പ്രക്രിയാശേഷി ഇവിടെ വിലയിരുത്തണം.**
- **ആശയവിനിമയം ചെയ്യൽ, ചിത്രീകരിക്കൽ തുടങ്ങിയ ശേഷികൾ.**

4. ചിത്രത്തിലാക്കാം

ഭിന്നസംഖ്യ ഉപയോഗിച്ച് ഒരു ചതുരത്തിന്റെ നിശ്ചിത ഭാഗങ്ങളെ സൂചിപ്പിക്കേണ്ടതെങ്ങനെയെന്ന് ബോധ്യപ്പെടുത്താനുള്ള ഒരു പ്രവർത്തനമാണിത്.



$\frac{1}{5}$, $\frac{2}{5}$, $\frac{1}{6}$, $\frac{2}{6}$, $\frac{3}{6}$ തുടങ്ങിയ ആശയങ്ങൾ കുട്ടികളിൽ എത്തിക്കാനും പ്രയോഗിച്ചു നോക്കുവാനുള്ള അവസരം ഒരുക്കുകയാണ് ഈ പ്രവർത്തനത്തിലൂടെ ഉദ്ദേശിക്കുന്നത്.

തന്നിരിക്കുന്ന ചിത്രങ്ങൾ വർക്ക്ഷീറ്റിൽ വരച്ച് നൽകുകയോ, റിബണുകളിൽ മുറിച്ച് നൽകുകയോ ആവാം.

- കുട്ടികൾ വ്യക്തിഗതമായി ചുതരങ്ങളെ ഭാഗങ്ങളാക്കുന്നു. നിറം നൽകുന്നു.
- 3 പേർ വീതം ഗ്രൂപ്പാകുന്നു. പരസ്പരം കൈമാറുന്നു. വ്യത്യാസങ്ങൾ കണ്ടെത്തുന്നു.
- ഗ്രൂപ്പവതരണം - ഭാഗിച്ച രീതി, ഓരോ ഭാഗവും എങ്ങനെ രേഖപ്പെടുത്തി എന്ന് വിശദീകരിക്കണം.
- ടീച്ചർ ട്രെയ്നി ബ്ലാക്ക് ബോർഡിൽ ഭാഗിച്ച് കാണിക്കുന്നു.
- ഇവിടെയും J Fraction Lab ഉപയോഗിച്ച് മേൽപ്പറഞ്ഞ പ്രവർത്തനം നടത്താം.

ക്രോഡീകരണം - ഭിന്നസംഖ്യയെന്നാൽ

- $\frac{3}{4}$ എന്നാൽ എന്താണ് ?

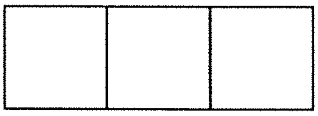
ഒരു വസ്തുവിനെ (അല്ലെങ്കിൽ അളവിനെ) 4 സമഭാഗങ്ങളാക്കി, അവയിൽനിന്ന് 3 എണ്ണം എടുത്താൽ കിട്ടുന്നതാണ് $\frac{3}{4}$

- ഇതിൽ ചുവടെ എഴുതിയ 4 നെ 'ഛേദം' എന്നും മുകളിലെഴുതിയ '3'നെ അംശം എന്നുമാണ് പറയുന്നത്.
- ഛേദിക്കുക എന്നാൽ മുറിക്കുക എന്നും, അംശം എന്നാൽ ഭാഗം എന്നുമാണ് അർത്ഥമാക്കുന്നത്.
- നാലിൽ മൂന്ന് എന്നത് $\frac{3}{4}$ എന്നും മൂന്നിൽ നാല് എന്നത് $\frac{4}{3}$ എന്നുമാണ് സംഖ്യാപരമായി സൂചിപ്പിക്കുന്നത്.

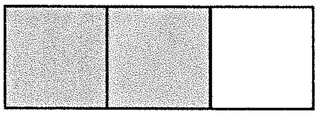
വിലയിരുത്തൽ : അളക്കൽ, കൃത്യത, നിഗമനത്തിലെത്തിച്ചേരൽ എന്നിവ.

5. ഭിന്നരൂപങ്ങൾ - സമാനഭിനം എന്ന ആശയം

ഒരു ചതുരം വെട്ടിയെടുത്ത് അതിൽ ചുവടെ കാണുന്നതുപോലെ 3 സമഭാഗങ്ങളാക്കുക. (OHP ഷീറ്റുകളിലാണ് ചതുരം വെട്ടിയെടുക്കേണ്ടത്).



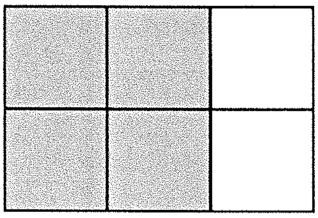
ഇതിൽ 2 ഭാഗം ഷേഡ് ചെയ്യുക.



ഷേഡു ചെയ്തത് ചതുരത്തിന്റെ $\frac{2}{3}$ ഭാഗത്തിനാണല്ലോ.

ഇനി, ചതുരത്തിന്റെ വിലങ്ങനെ ഒരു വര വരയ്ക്കുക.

(ഇവിടെ വരകൾ OHP മാർക്കർ ഉപയോഗിക്കുക)



ഇപ്പോൾ ചതുരം ആകെ 6 ഭാഗങ്ങളായി. അതിൽ 4 ഭാഗം ഷേഡു ചെയ്തിട്ടുണ്ട്.

അതായത്, ചതുരത്തിന്റെ $\frac{4}{6}$ ഭാഗത്തിനാണ് ഷേഡു ചെയ്തത്. അപ്പോൾ, മേൽകൊടുത്ത 2 ചതുരങ്ങളും കൂടി മേൽക്കുമേൽ ചേർത്തുവെച്ചാൽ രണ്ട് ഷേഡുചെയ്ത ഭാഗങ്ങളും തുല്യമാണെന്ന് കാണാം.

അതായത് $\frac{2}{3}$, $\frac{4}{6}$ എന്ന് ലഭിക്കുന്നു.

- $\frac{2}{3}$ ഉം $\frac{4}{6}$ ഉം സമാന ഭിന്നസംഖ്യകളാണ്.
- TB Page 71 (Std. 5) ലെ ഭാഗം പലതരം എന്ന പ്രവർത്തനം നോക്കുക.

വേണ്ട സാമഗ്രികൾ

- OHP ഷീറ്റ്, OHP മാർക്കർ, സ്കെയിൽ.

6. മറ്റൊരു വ്യാഖ്യാനം

2 മീറ്ററിനെ 3 സമഭാഗങ്ങളാക്കിയാൽ ഓരോ ഭാഗത്തിന്റെയും നീളം എത്രയാണ്?

Step - 1

ആദ്യം ഇതിലെ ഓരോ മീറ്ററിനെയും മൂന്നായി സമഭാഗം ചെയ്തു നോക്കാം.

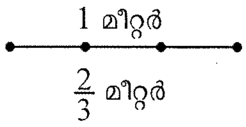
2 മീറ്ററിന്റെ 3 സമഭാഗങ്ങൾ ഇവിടെ കിട്ടി.

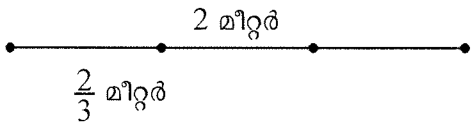
ഓരോ ഭാഗവും 1 മീറ്ററിന്റെ 3 സമഭാഗങ്ങളിൽ 2 എണ്ണം ചേർന്നതാണല്ലോ.

അതായത്, 1 മീറ്ററിന്റെ $\frac{2}{3}$ ഭാഗം, അഥവാ $\frac{2}{3}$ മീറ്റർ.

ക്രോഡീകരണം

1 മീറ്ററിനെ 3 സമഭാഗങ്ങളാക്കിയതിലെ 2 ഭാഗത്തിന്റെ നീളവും, 2 മീറ്ററിനെ 3 സമഭാഗങ്ങളാക്കിയതിലെ ഒരു ഭാഗത്തിന്റെ നീളവും $\frac{2}{3}$ മീറ്റർ തന്നെയാണ്.





വർക്ക്ഷീറ്റ്

വിട്ടുപോയ ഭാഗങ്ങൾ പൂരിപ്പിക്കുക.

(a) $\frac{3}{7}+\frac{2}{7}=\frac{5}{-}$

(b) $\frac{5}{11}+\frac{4}{11}=\frac{-}{11}$

(c) $\frac{6}{11}+\frac{-}{13}=\frac{9}{13}$

(d) $\frac{-}{10}+\frac{2}{10}=\frac{7}{10}$

(e) $\frac{6}{-}+\frac{2}{-}=\frac{7}{10}$

(f) $\frac{9}{21}+\frac{5}{21}+\frac{-}{21}=\frac{17}{21}$

പ്രവർത്തനം

$\frac{1}{2}+\frac{1}{4}=\frac{2}{6}$ എന്ന രീതിയിൽ തെറ്റു വരുത്തിയാൽ എങ്ങനെ തെറ്റ് ബോധ്യപ്പെടുത്തും ?

$\frac{1}{2}+\frac{1}{2}=\frac{2}{4}=\frac{1}{2}$ ആകുമോ ? ഈ രീതിയിൽ കണ്ടെത്തുന്നത് ശരിയായ രീതിയല്ല.

$\frac{1}{2}+\frac{1}{4}$ എത്ര ? (അരയും കാലും ചേർന്നാൽ എത്രയാകും). $\frac{3}{4}$ എന്ന് ചിലരെങ്കിലും പറഞ്ഞേയ്ക്കാം.

$\frac{2}{6}$ എന്ന ഉത്തരത്തിൽ $\frac{2}{6}=\frac{1}{3}$ ആണ്. (ഇതിൽ നിന്നും ഉത്തരം തെറ്റി എന്നും ബോധ്യപ്പെടുന്നു. $\frac{1}{3}$ എന്നത് $\frac{1}{2}$ നേക്കാൾ ചെറുതാണ് എന്ന് കുട്ടിക്കറിയാം.

പ്രവർത്തനം

അച്ഛൻ തന്റെ സ്വത്തിൽ $\frac{3}{5}$ ഭാഗം മകനും $\frac{1}{3}$ ഭാഗം മകൾക്കും കൊടുത്തു. രണ്ടുപേർക്കും കൂടി തന്റെ സ്വത്തിന്റെ എത്രഭാഗമാണ് വീതിച്ചു നൽകിയത് ?

ഈ പ്രശ്നത്തിൽ $\frac{3}{5}+\frac{1}{3}=\frac{4}{8}$ എന്ന് ചിലരെങ്കിലും എഴുതിയിട്ടുണ്ടാവാം. ഈ തെറ്റ് എങ്ങനെ പരിഹരിക്കും ?

ഇവിടെ $\frac{3}{5}$ ഭാഗം എന്നത് പകുതിയേക്കാൾ കൂടുതലാണ്. ഇവിടെ $\frac{3}{5}$നോട് $\frac{1}{3}$ കൂട്ടിയപ്പോൾ $\frac{4}{8}$ ആണ് കിട്ടിയത്. $\frac{4}{8}=\frac{1}{2}$ ആണെന്നറിയാം. $\frac{3}{5}$ എന്ന സംഖ്യ $\frac{1}{2}$ നേക്കാൾ വലുതാണ്.

Reference

1. ഗണിതകൗതുകം-കേരളശാസ്ത്രസാഹിത്യ പരിഷത്
2. കണക്ക് -കളിയും കാര്യവും-രാമചന്ദ്ര മേനോൻ
3. ഭിന്നസംഖ്യകൾ- TEXT BOOK,STD 6,7, NCERT

Appendix-F4

SELF LEARNING MODULE

FOR PROSPECTIVE TEACHERS

PEDAGOGIC MODULE

FRACTIONS

FRACTIONS

History

While measuring the length, weight, area, volume etc. on the basis of certain units, we need more numbers than the natural numbers. For example while measuring the length of a string having unit length, there is a chance to arise a problem like how to represent the length of a string having the length less than that of the string. Thus we need the numbers which represent half of the length of the string or one by third of the string etc. This leads to the origin of fractions.

Introduction

When we consider fractions formed from the quantities / measurements as absolute mathematical concepts, we may taken account of different numbers other than natural numbers. For example, the concept 'Half' comes first as one among the two equal parts and it can be written as $\frac{1}{2}$.

In our day to day dealings we need to apply the concepts like quarter, half, three fourth etc. in different situations. This module includes the activities that organize these concepts mathematically.

MODULE - II

Fractions (ഭാഗങ്ങളുടെ സംഖ്യ)

You can achieve the following objectives through studying this module.

1. To know the concept of fraction.
2. To know the different situations of partitioning definite numbers into halves.
3. To get the knowledge of partition of objects into halves having definite shape.
4. To get the idea about the concept $\frac{1}{4}$ and $\frac{3}{4}$
5. To recognize the different forms of types of fractions.
6. To get the ability to explain the relationship between fractions, comparison, interpretation and prediction of fractions.

MODULE FRAME

Concepts	Pedagogic Analysis	Objectives/Learning Customers
• There are many situations in which fractions are used. • Situations of partitioning definite number of objects into half.	• Make situations, explanation, problem solving, relationship for understanding the fractions which remain when we count or measure something in our life.	• Explain the method of dividing an object oor definite numbers into halves.
• There are different methods to partition an object having definite shape into halves.	• Activity for partitioning & geometric figures into half. (Rectangle, circle)	• Recognition of part ½
• If an object or a definite shape is equally divided into two, then each part is called as one by two of the total.	• Activities for colouring the parts and divide the figures/shapes into half (½)	• Partition into ½

Concepts	Pedagogic Analysis	Objectives/Learning Customers
• If an object is equally divided into four, then one among the parts is called one by fourth of total or $\frac{1}{4}$	• Explain the problems of division of a place into four equal parts related to life and solve.	• Divide different figure/shape into $\frac{1}{4}$
• If an object is equaly divided into four. Then three parts of the total called three by fourth or $\frac{3}{4}$	• Explain the problem of division of an object into 4 equal parts and its solution.	• Find out the ½, ¼, ¾ from the parts of different shapes. And explain its logic.
• It is written as $\frac{3}{4}$ and read it as three by four.	• Present the real life situations of division of an object into 4 equal parts. • Applications of ½, ¼, ¾ in our daily life.	
• We can write one fraction as equivalent to another fraction.	• Activity to write one fraction into its equivalent fractions.	• Can say and write the problems in division as fractions.
• We can interpret the operation division as fraction and vice versa.	• Activity for producing fractions through the partitions of group of objects. • Activity for the formation and explanation of fractions using ICT.	• Develop the ability to say and write the quotient.

Methodology

You can select the following methods to represent a fraction, learning methods should be appropriate to the children to attain the objectives.

(i) Analytic - synthetic method

(ii) Experimental method

(iii) Discovery method

Prerequisites needed for children

Children should have the previous knowledge about the following concepts to learn about fraction

1. **Integers**

Integers are the group of numbers which includes positive integers and negative integers.

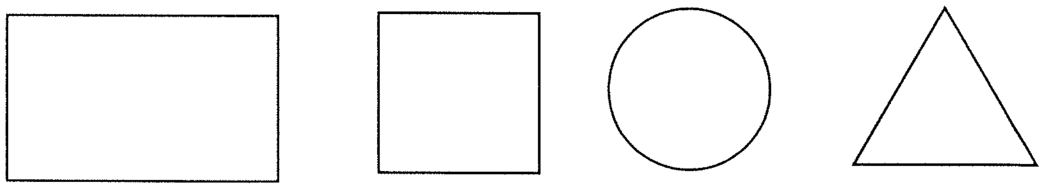
2. **Here positive integers are considered**

eg:- Choose the integer in the following

5.5, 2.3, 2.7, 3, 14.2

Here 3 is the integer.

Different geometrical figures



Rectangle Square Circle Triangle

Division of numbers

eg: (1)

When dividing '8' by '4' we find how many 4's are in 8 and write it as $\frac{8}{4}$.

That is, how many groups of 4 are contained in 8 and we get the answer 2.

eg: (2)

When dividing 2 by 3, it can be represented by using the fraction $\frac{2}{3}$.

Ability to measure

Children can use scales and protractors to measure length and angle respectively.

Needed equipments

Teacher should use different equipments which are suitable for pedagogic activity.

Following are the pedagogic equipments, which can be used in certain situations.

1. Fraction disc kit.
2. Thread, Ribon, Scale, Protractor
3. Paper cuttings of differnet shapes
4. Charts, pencil, colour kit.

LEARNING ACTIVITIES

1. Bisection

Anu and Vinu are twins. On their birthday father gave gifts of a packet of 10 sweets and two cakes of rectangular and circular shapes. Father said them to equally divide all gifts.

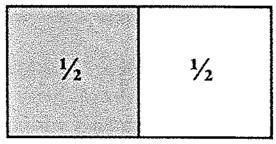
Anu and Vinu partitioned equally the sweets as shown in below.

Is it correct? Vinu also agreed. So they got 5 sweets each. Anu said that I give you one by two of the total sweets.

Yes. But it is enough to say that the half of the total. At that time their father came and said that one by two of the total and half of the total are equal. So both of you are correct. OK - New Anu and Vinu are satisfied. Then, next both Anu & Vinu decided to divided the rectangular and circular cake into equal two parts.

First they took the rectangular cake. But how can be divide this?

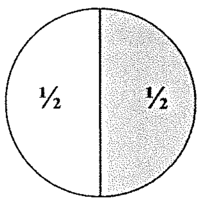
hmm.... I have an idea. I will measure the length of the cake, Vinu said. They cut the cake by measuring the length.



Vinu gave one part to Anu.

So, half can be made this way also. Anu said.

Now Anu and Vinu cut the circular cake in similar way. The cake doesn't have much thickness. So they cut the cake through the center.



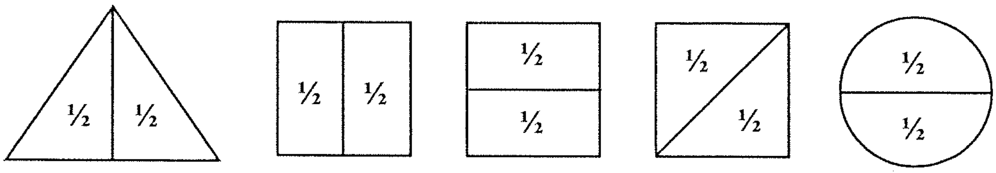
Ohh... It is also correct half. Vinu said. One piece for you and other for me. Anu cut the calve. So one of two pieces got Anu and other to Vinu. That is both Anu and Vinu got half of the cake.

Codification

- Should understand how to divide equally the definite number of objects and one among the total is one by two or half of the total.

- One by two is called as half, and mathematically it is represented as ½.
- Should recognize how to bisect the circular and rectangular shapes and also the different methods of bisection.

eg:

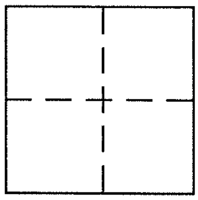


- Should be practiced the activity. How many parts in page 121 of the textbook. Evaluation, Comparison, Identification.
- Give activities mentioned in TB page 122 such as half in rectangle, partition of sweets.

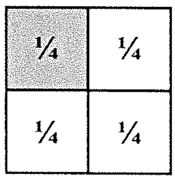
  Evaluation : Concept of half, accuracy, exactness.
- Present the concepts such as half of 1 metre is ½ metre and half of 1 litre is ½ litre.

2. Again Partitioning (വീണ്ടും ഭാഗിച്ചപ്പോൾ)

At that time Anu's uncle came and gave a choclate as birthday gift. The shape of the choclate is given below.



When they are trying to divide the choclate equally, their friends Babu and Sunil came. So Anu & Vinu decided to give choclate to them also. Then they have to divide choclate into 4 equal parts. Thus each of them got 1 piece of the total 4 pieces.



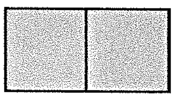
Babu said that one part among the 4 equal parts is quarter, yes. We can represent quarter numerically as ¼. Sunil added.

This leads to a discussion between the 4. Howmany parts got Anu and Vinu.

Anu got ¼

Vinu got ¼

Then howmany parts got both together join both ¼ parts. Babu said.



Then get half of the total choclate. Anu replied. That is two one by foarths are joined to get half of the total choclate.

Then what will get when $\frac{1}{4}$ and $\frac{1}{4}$ joined.

That is $\frac{1}{4} + \frac{1}{4} = \frac{2}{4} = \frac{1}{2}$ Half of the choclate. Now, if we join the parts of the choclate given to Sunil and Babu what will be the result?

That also $\frac{1}{4} + \frac{1}{4} = \frac{1}{2}$

i.e., half of the total choclate. If we joined the four choclate pieces, then we get the total choclate.

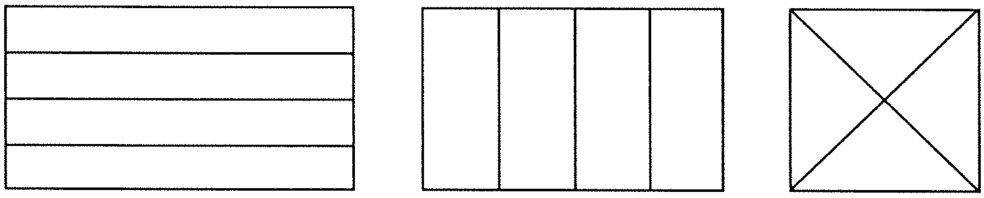
That is $\frac{1}{4} + \frac{1}{4} + \frac{1}{4} + \frac{1}{4}$

$$= \frac{2}{4} + \frac{2}{4} = \frac{4}{4} = 1$$

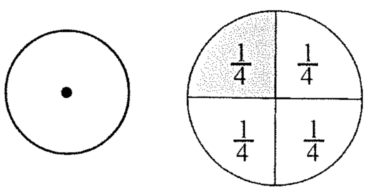
So, if we divide an object into 4 equal parts then one of the part is one by fourth of the total or $\frac{1}{4}$

Codification

- If we divide a finite number of objects into 4 equal parts then one of the part of the total is one by fourth.
- If we divide one shape into 4 equal parts, then one of the part of the total is $\frac{1}{4}$
- $\frac{1}{4}$ is also known as quarter.
- We can divide the shapes into quarter in different ways.



- Give the activity 'Draw and colour the parts' in page No. 125 of TB to students.
- Present the concept $\frac{1}{4}$ using fraction disc.

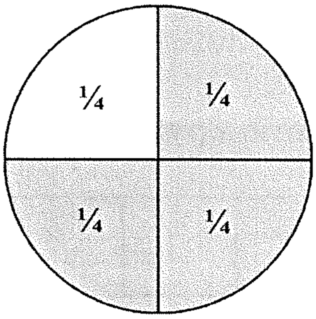


- Present the above concept using ICT resources and T fraction lab.

(Application → Education → T fraction lab → Clicking the Nr.)

3. Harvest

There is a large pumpkin in the garden of Anu and Vinu. They plucked the pumpkin and divided it into 4 equal parts. One part is used for cooking. Anu, Vinu and Babu took the remaining parts. Here harmany parts got Anu, Vinu and Babu together ?



3 parts among 4 equal parts.

That is $\frac{3}{4}$ parts

Now, if we joint all three parts together what will we get?

$$\frac{1}{4} + \frac{1}{4} + \frac{1}{4} = \frac{1}{2} + \frac{1}{4}$$

= Half + quarter

= Three by four

Three fourth is called three parts of total 4 parts.

That is three fourth = $\frac{3}{4}$

We can interpret this as follows.

(1) $\frac{1}{4} + \frac{1}{4} + \frac{1}{4} = \frac{(1 + 1 + 1)}{4} = \frac{3}{4}$

(2) $\frac{1}{4} + \frac{1}{4} + \frac{1}{4}$, $3 \times \frac{1}{4} = \frac{3}{4}$

(3) Sum of three quarters is three by four.

(4) Substract the quarter from whole, we get three by fourth of the whole.

That is, $1 - \frac{1}{4} = \frac{3}{4}$

(5) $\frac{1}{4} + \frac{1}{4} + \frac{1}{4} = \frac{2}{4} + \frac{1}{4} = \frac{3}{4}$

(6) $\frac{1}{4} + \frac{1}{4} + \frac{1}{4} = \frac{2}{4} + \frac{1}{4} = \frac{4+2}{8} = \frac{6}{8} = \frac{3}{4}$

Consolidation

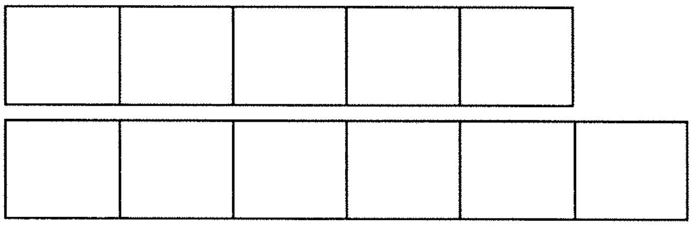
- If we divide an object into 4 equal parts the three parts among them is known as three by four.
- The activity different types of parts.

Evaluation

- Evaluate the ability of analysing.
- Evaluate the abilities like communication picturisation etc.

4. Let us picturise

This is an activity to convince pupil, how to represent finite parts of a rectangle using fractions.



This activity aims to give an opportunity for conveying the concepts and to apply the fractional numbers like, $\frac{1}{5}$, $\frac{2}{5}$, $\frac{1}{6}$, $\frac{2}{6}$, $\frac{3}{6}$ etc.

The above figures are given to the pupil by drawing it in a worksheet or by cutting a ribbon.

- Students divide the rectangles individually and colour it.
- Make groups of 3 pupils and they share and find and differences.
- Group presentation - method of partition, explanation of how they represented each parts.
- Teacher shows the partitioning in black board.
- Teacher can use 'T fraction lab' for conducting the above activity.

Consolidation

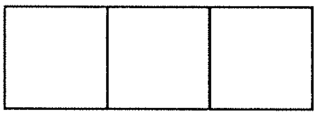
- What is $\frac{3}{4}$

  An object or quantity is divided into 4 equal parts. Then 3 parts of the total is $\frac{3}{4}$
- In this 4 is known as denominator and 3 is the numerator.
- Denomentor is devisor and a numerator is divident.
- Three by four is numerically represented as $\frac{3}{4}$ and four by three as $\frac{4}{3}$.

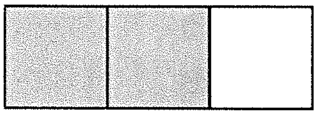
Evaluation : Measurement, Accuracy, Formation of generalization etc.

5. **The concept of equal fraction**

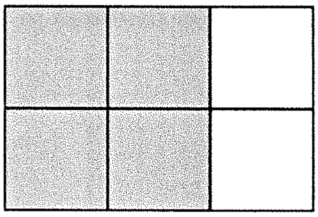
Cut a rectangle and divide if into 3 equal parts as shown below. (Rectangle with OHP sheets).



Then shade two parts of the rectangle.



Here $\frac{2}{3}$ parts of the rectangles is shaded. Now draw a line horizontally through the rectangle. (Use OHP maker for drawing lines).



Now the rectangle has 6 equal parts and 4 parts are shaded.
i.e., $\frac{4}{6}$ parts of the rectangle is shaded. So if we place the above 2 rectangles together one below another we can see that both shaded rectangles are equal.
i.e, we get $\frac{2}{3} = \frac{4}{6}$

- $\frac{2}{3}$ and $\frac{4}{6}$ are equal fractions.
- See the activity (Different parts on page 71)

Required equipments

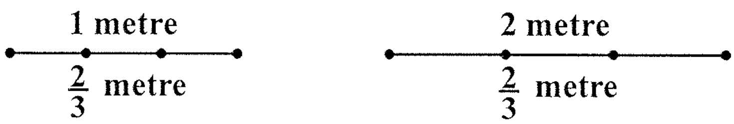
OHP sheet, OHP marker, scale.

6. **Another interpretation**

If 2 metre is divided into 3 equal parts then what is length of one part?

Step - 1

First divide each 1 metre into 3 equal parts.



FRACTIONS

Introduction

Fractions are needed while dividing a whole. The students should be able to write the numbers greater than one as a combination of natural numbers and fractions and vice versa. The aims of these types of activities are to find equal fractions, doing problems using this concept, solving real life problems etc.

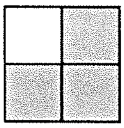
Concepts

1. Fractions are the numbers of parts.
2. $\frac{3}{4}$ is the 3 parts of the 4 equal parts. It is the combination of three $\frac{1}{4}$'s.
3. A fraction can be written as another form of fraction which is equal to the first one.
4. Fractions interpretate as a division problem or vice versa.
5. Addition of fraction.
6. Subtraction of fraction
7. Multiplication of fraction
8. Division of fraction
9. Numbers greater than one can be written as a combination of +ve integers and fraction.

Pre-test questions

A. 1. ½ = ...

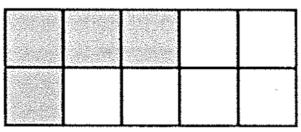
$\left[\frac{3}{6}, \frac{3}{4}, \frac{2}{5}, \frac{1}{4}\right]$

2.  Write the fraction which represent the shaded portion in the figure?

3. Which is the smallest fraction ?

$\left[\frac{1}{6}, \frac{1}{4}, \frac{1}{3}, \frac{1}{2}\right]$

4. If numerator = 11 and denominator = 25 then write the fraction ?

5.  How many rectangles are to be shaded in order to get $\frac{4}{5}$?

B. 1. Find $\frac{1}{3} + \frac{1}{4}$

2. Raju and Suma are taking mangoes from a basket. Raju took $\frac{1}{3}$ of the total mangoes and Suma took $\frac{1}{6}$ of the total. Then, how many mangoes are remaining in the basket.

$\left[\frac{1}{2}, \frac{1}{3}, \frac{1}{6}, \frac{1}{18} \right]$

3. Find $\frac{4}{8} - \frac{2}{8}$

4. Find $\frac{1}{3}$ of $\frac{1}{2}$

5. $\frac{3}{12} \div \left[\frac{1}{3} \times \frac{1}{4} \right]$

$\left[\frac{3}{12}, \frac{1}{12}, \frac{1}{3}, \frac{3}{1} \right]$

6. $\frac{3}{5} - \frac{1}{3}$ എത്ര ?

7. Among the following which one contains fraction that all are equal?

a. $\frac{1}{2}, \frac{2}{4}, \frac{4}{6}$ b. $\frac{2}{3}, \frac{4}{6}, \frac{8}{12}$ c. $\frac{2}{5}, \frac{4}{10}, \frac{8}{50}$

d. $\frac{3}{4}, \frac{4}{6}, \frac{6}{8}$

8. Find (a) $\frac{1}{2} + \frac{1}{3}$ b. $\frac{1}{2} - \frac{1}{3}$ c. $\frac{1}{2} \times \frac{1}{3}$ d. $\frac{1}{2} \div \frac{1}{3}$

9. Formulate an application level problem on the basis of the operation $1\frac{1}{2} \div \frac{3}{4}$

What are the problem found after conducting the pretest. Check some of the answers written by students.

MISCONCEPTION AMONG STUDENTS

1. $\frac{1}{5} + \frac{3}{5} = \frac{4}{10}$ $\left[\frac{1}{5}, \frac{3}{5} \right.$ are parts of an object which is equally divided into 5 parts)

2. $\frac{3}{4} + \frac{2}{3} = \frac{5}{7}$ (Do not have the concept about the value of fraction)

$\frac{1}{2} + \frac{1}{2} = \frac{2}{4} = \frac{1}{2}$ It is not correct.

3. $\frac{1}{2} + \frac{3}{4} = \frac{4}{6}$ [Doesn't have the idea about when $\frac{1}{2}$ and $\frac{3}{4}$ are added which is greater than 1]

4. $\frac{3}{5} + \frac{1}{3} = \frac{2}{3}$ (Do not have the idea about the value and equalize the denomenator)

5. $\frac{2}{3} \times \frac{1}{3} = \frac{2}{3}$ (Do not have the concept about the multiplication of fractions)

6. $\frac{2}{3} \div \frac{4}{5} = \frac{8}{15}$ (Doesnot have the logic of using reciprocals when dividing two fractions)

Activity

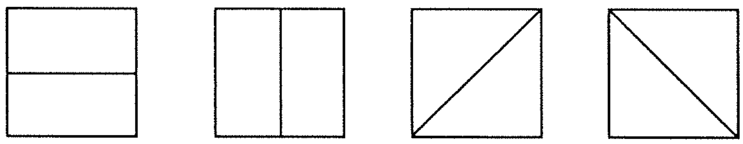
Give rectangular papers to all students and ask them to fold the paper into two.

Did you get two equal parts?

Provide next instruction to students after confirming all are foled in the same manner.

In how many ways we can fold a peper into half ?

Teacher draw different ways which are used by the students on BB.



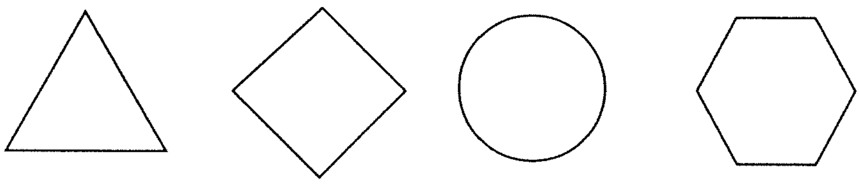
Here a rectangle is divided into 2 equal parts. Now can you draw a figure and divide into 2 equal parts?

Teacher introduces 'Half' from the concept of two equal parts and can write it as ½. (Half is the one part of the two equal parts of an object).

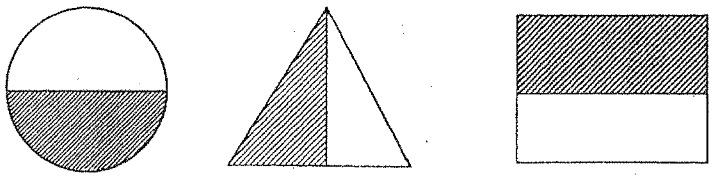
This can be read as 'Half' or one by two.

Worksheet - 1

Colour the $\frac{1}{2}$ part of the following pictures.



Activity



Write the fraction corresponding to the shaded region of the figure.

Some children may write. It as $\frac{2}{1}$

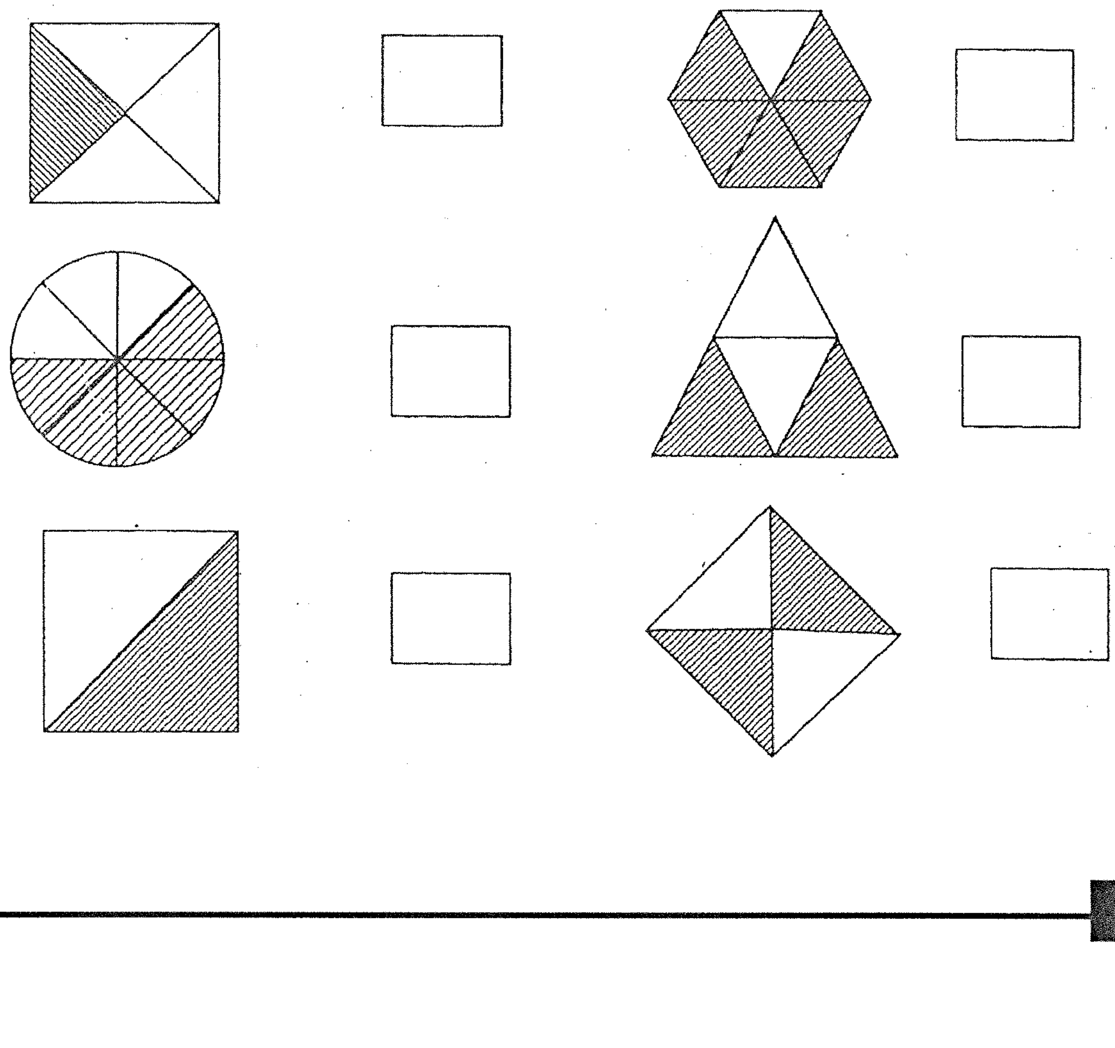
For Teacher

Fractions are used when a whole is divided into many parts or to represent how many of total are there. The number which write below the line of a fraction is the total number.

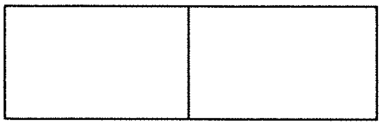
In $\frac{1}{2}$; 1 represent the numerator and 2 is the denomenator.

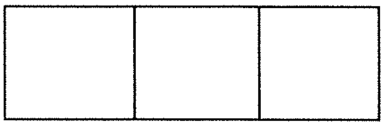
Work sheet - 2

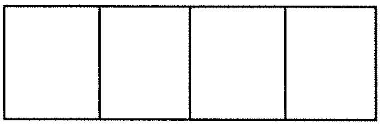
How many parts are shaded in each figure?

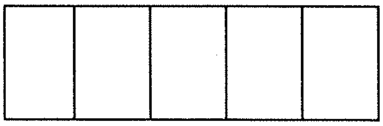


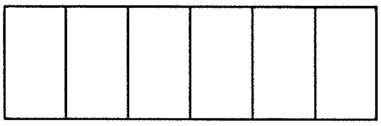
Activity

1 

2 

3 

4 

5 

Give 5 paper pieces as shown in the above figures having equal sizes to students and ask them to colour one part. Write the fraction of coloured part.

Students have to write $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{5}$, $\frac{1}{6}$

But some of them may write as $\frac{3}{1}$ (opposite way)

The number which write below the line in a fraction represent how many partitions are there.

Now can you say which is the smallest fraction?

Write the items given below as fractions.

1. 1 in 4
2. 1 in 8
3. 1 in 6
4. 1 in 10

The cut the coloured region in the above figure and exhibit on BB.

Among this which figure contains more shaded region ?

From this we found that $\frac{1}{2}$ is the largest fraction and $\frac{1}{6}$ is the smallest fraction.

Now, arrange it in ascending order.

For teacher

From the above activity students should get an idea about the size / value of the fraction. $\frac{1}{3}$ means 1 is equally divided into 3 and $\frac{1}{4}$ means 1 is equally divided into 4. From this teacher should convey the idea about which one is large and how to find it.

Activity

Arrange the following fraction in the order of value (or in ascending order).

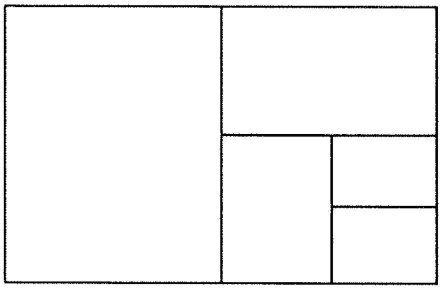
$$\frac{2}{8},\ \frac{2}{10},\ \frac{2}{4},\ \frac{2}{12},\ \frac{2}{6}$$

For teacher

If 3 meter is divided into 4 equal parts. Then it can be written as $3 \div 4$ or $\frac{3}{4}$

Partition of 3 into 4 equal parts means it is enough to see half of half of 3. That is half of 3 metre is 1½ and half of it is 75 cm.

Worksheet



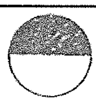
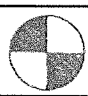
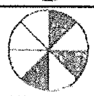
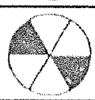
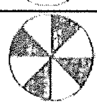
A group of students are trying to colour the given table sheet. Can you help them?

$\frac{1}{2}$ Part Red $\frac{1}{4}$ Part Blue

$\frac{1}{8}$ Part Green $\frac{1}{16}$ Part Black

Worksheet

On Christmas, the equal size cakes are cut in children's home. Each child got different size cake pieces and it is shaded in the figure. How many of them got equal size of cake pieces.

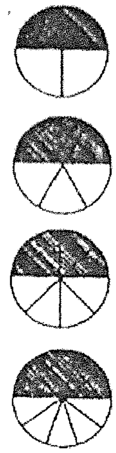
Name	Part of Cake	Fraction
Appu		
Chikku		
Ammu		
Chinnu		
Kukku		

Activity

Make 4 groups of students and give 4 circles having equal size to each group. First group have to shade $\frac{2}{4}$ of the circle and 2nd, 3rd, 4th group have to shade $\frac{3}{6}$, $\frac{4}{8}$, $\frac{5}{10}$ respectively. From this can you find the group whose shaded large region ?

Each group shade the circle and let them exhibit in class room. Teacher drawn the pictures on BB.

1. $\longrightarrow$ $\frac{2}{4}$
2. $\longrightarrow$ $\frac{3}{6}$
3. $\longrightarrow$ $\frac{4}{8}$
4. $\longrightarrow$ $\frac{5}{10}$



For teacher

Teacher can give the activities is using pictures and OHP sheets.

After exhibiting the pciture the students can understand that all the four groups shaded the half of the circle.

Half is written as ½.

Ask to the students that is there any relation b/w fraction of shaded region and the fraction ½? In the first picture $\frac{2}{4}$ means 2 parts among 4 equal parts. From this we get,

$$\frac{1}{2} = \frac{2}{4}, \frac{1}{2} = \frac{3}{6}, \frac{1}{2} = \frac{4}{8}, \frac{1}{2} = \frac{5}{10}$$

And found that are shaded portions of each groups are equal. Say to the students to write the other equal fractions of ½ as follow up activity.

For teacher

In addition give the idea about equal fraction introduce the method of finding equal fractions. (Multiply the numerator and denomenator with same number).

Give the opportunity to write equal fractions of ¼.

Activity

Write the equal fractions of following fractions?

1) $\frac{2}{5} =$ 2) $\frac{3}{6} =$

2) $\frac{4}{8} = \frac{-}{40}$ 4) $\frac{2}{6} = \frac{10}{-}$

5) $\frac{10}{20} = \frac{5}{-}$ 6) $\frac{6}{12} = \frac{-}{-}$

Worksheet

Classification / Let us classify.

Classify the fraction given below as greater ½ and less than ½.

$\boxed{\frac{3}{4}}$

$\boxed{\frac{2}{3}}$ $\boxed{\frac{3}{4}}$

$\boxed{\frac{1}{3}}$ $\boxed{\frac{2}{5}}$ $\boxed{\frac{3}{5}}$ $\boxed{\frac{4}{5}}$

$\boxed{\frac{2}{4}}$ $\boxed{\frac{2}{6}}$ $\boxed{\frac{3}{6}}$ $\boxed{\frac{1}{5}}$

$\boxed{\frac{1}{6}}$ $\boxed{\frac{4}{6}}$ $\boxed{\frac{5}{6}}$

Greater than $\frac{1}{2}$	Less than $\frac{1}{2}$

Is there any fraction which doesnot belong to any of the groups.

Activity 4

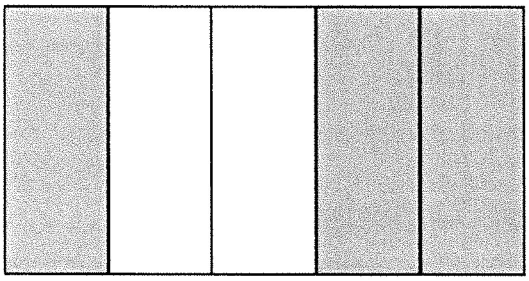
Raju decided to cultivate vegetables in his place. He divided the total field into 5 equal parts and cultivated spinach in one part and Bitterguard on 2 parts. Then how many parts are used to total cultivation?

How much area is used to cultivate spinach ? $\frac{1}{5}$ part

How much area is used to Bitter guard $\frac{2}{5}$ part

Then total area used $\frac{1}{5} + \frac{2}{5}$?

Teacher draws the picture on BB.



Total shaded region - 3

How many among total? $\frac{3}{5}$ part.

From this student gets an idea about $\frac{1}{5} + \frac{2}{5} = \frac{3}{5}$

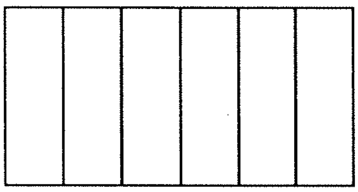
How can be solved, if one child writes it as $\frac{1}{5} + \frac{2}{5} = \frac{3}{10}$

Students know that $\frac{2}{5} = \frac{4}{10}$. If $\frac{1}{5}$ is added to $\frac{4}{10}$ then we should get the number which greater than $\frac{4}{10}$

To how many parts did Raju divide his field? 5 parts. He cultivated spinach in one part and Bitterguard in 2 parts. Teacher can present this concept with the help of OHP sheet and pictures.

In the given figure below give blue, red, and green colour for the regions $\frac{2}{6}$, $\frac{1}{6}$ and $\frac{2}{6}$ parts respectively.

How many parts are coloured.



Worksheet

Fill in the blanks.

a) $\frac{3}{7} + \frac{2}{7} = \frac{5}{-}$

b) $\frac{5}{11} + \frac{4}{11} = \frac{-}{11}$

c) $\frac{6}{11} + \frac{-}{13} = \frac{9}{13}$

d) $\frac{-}{10} + \frac{2}{10} = \frac{7}{10}$

e) $\frac{6}{-} + \frac{2}{-} = \frac{7}{10}$

f) $\frac{9}{21} + \frac{5}{21} + \frac{-}{21} = \frac{17}{21}$

Activity

How can it be clarified if children make the mistake as

$$\frac{1}{2} + \frac{1}{4} = \frac{2}{6} \ ?$$

is $\frac{1}{2} + \frac{1}{2} = \frac{2}{4} = \frac{1}{2}$? This is not a correct way.

what is $\frac{1}{2} + \frac{1}{4} = \frac{1}{2}$? What is the sum of half and quarter ?

Some children may answer $\frac{3}{4}$

If they give answer $\frac{2}{6}$, $\frac{2}{6} = \frac{1}{3}$? From the teacher can clarify that the answer is wrong. Because child knows that $\frac{1}{3}$ is smaller that $\frac{1}{2}$.

Activity

Father gave $\frac{3}{5}$ part of his wealth to the son and $\frac{1}{3}$ part to the daughter. Then how many parts of his total wealth get partitioned.

In this problem some students may write as $\frac{3}{5} + \frac{1}{3} = \frac{4}{8}$. How can be correct it?

Here $\frac{3}{5}$ part is greater than half. Here child got $\frac{4}{8}$ when $\frac{3}{5}$ is added to the $\frac{1}{3}$. But child know that $\frac{4}{8} = \frac{1}{2}$, $\frac{3}{5}$ is greater than $\frac{1}{2}$.

Appendix G

Digital Support of the Module

Appendix. H

Rating scale about the usefulness of the developed SLM in Mathematics for the prospective teachers at primary level

The details of the content outputs and structural aspects of the developed SLM are given below. Kindly rate it as per the possible response.

....

a)CONTENT

1. The content is comprehensive with respect to primary mathematics education — Agree/Disagree
2. The content given is error-free — Agree/Disagree
3. Content is simple to understand — Agree/Disagree
4. Content is properly illustrated — Agree/Disagree
5. Content is given as need based — Agree/Disagree
6. Content follows a sequential order — Agree/Disagree
7. Content is presented in digital form with easy access — Agree/Disagree

b) STRUCTURE

1. Content is presented in sections and subsections with proper title — Agree/Disagree
2. Each sections is well-structured with clear introduction, Objectives, main concepts, learning activities, follow-up activities and reference — Agree/Disagree
3. The digital form of the SLM is well-designed — Agree/Disagree

Suggestions if any:

Teacher trainees lack content knowledge. Basic content knowledge is very much needed for the fruitful transaction of the subject. This material enriches the trainees and helps in enhancing the subject

Signature

Name, official address of the teacher educator Anju M. Antony, K.S.N.I.T.E, Ottapalam, Palakkad dist, Ph.No.9388886161.

Rating scale about the usefulness of the developed SLM in Mathematics for the prospective teachers at primary level

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....

a)CONTENT

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5. Content is given as need based — Agree/Disagree
6. Content follows a sequential order — Agree/Disagree
7. Content is presented in digital form with easy access — Agree/Disagree

b) STRUCTURE

1. Content is presented in sections and subsections with proper title — Agree/Disagree
2. Each sections is well-structured with clear introduction, Objectives, main concepts, learning activities, follow-up activities and reference — Agree/Disagree
3. The digital form of the SLM is well-designed — Agree/Disagree

Suggestions if any: Very good in it's content, ~~and~~ easy to follow, and useful to teachers at primary level.

Signature

Name, official address of the teacher educator

KARUNA TEACHER TRAINING INSTITUTE
PRABHAPURAM P.O Mannengode Pattambi Palakkad Pin: 679 307

Prabhapuram

Rating scale about the usefulness of the developed SLM in Mathematics for the prospective teachers at primary level

The details of the content outputs and structural aspects of the developed SLM are given below. Kindly rate it as per the possible response.

a)CONTENT

1. The content is comprehensive with respect to primary mathematics education — Agree/Disagree
2. The content given is error-free — Agree/Disagree
3. Content is simple to understand — Agree/Disagree
4. Content is properly illustrated — Agree/Disagree
5. Content is given as need based — Agree/Disagree
6. Content follows a sequential order — Agree/Disagree
7. Content is presented in digital form with easy access — Agree/Disagree

b) STRUCTURE

1. Content is presented in sections and subsections with proper title — Agree/Disagree
2. Each sections is well-structured with clear introduction, Objectives, main concepts, learning activities, follow-up activities and reference — Agree/Disagree
3. The digital form of the SLM is well-designed — Agree/Disagree

Suggestions if any:

The support materials given ~~in the~~ was found very helpful to Teacher ~~training~~ Trainees during their Internship in primary classes.

Signature

Name, official address of the teacher educator

Jyothama C G

Teacher Educator,
GITE, Chittur, Palakkad.
Ph. No: 9947753909

Rating scale about the usefulness of the developed SLM in Mathematics for the prospective teachers at primary level

The details of the content outputs and structural aspects of the developed SLM are given below. Kindly rate it as per the possible response.

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7. Content is presented in digital form with easy access — Agree/Disagree

b) STRUCTURE

1. Content is presented in sections and subsections with proper title — Agree/Disagree
2. Each sections is well-structured with clear introduction, Objectives, main concepts, learning activities, follow-up activities and reference — Agree/Disagree
3. The digital form of the SLM is well-designed — Agree/Disagree

Suggestions if any:

1. Question and answers better for each contents
2. More TLMs are needed.

Signature

Name, official address of the teacher educator

Anvar. K
Teacher educator (Maths)
Karuna IFE, Prabhapuram
Palakkad.
Ph: 9947308285

Rating scale about the usefulness of the developed SLM in Mathematics for the prospective teachers at primary level

The details of the content outputs and structural aspects of the developed SLM are given below. Kindly rate it as per the possible response.

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a)CONTENT

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b) STRUCTURE

1. Content is presented in sections and subsections with proper title — Agree/Disagree
2. Each sections is well-structured with clear introduction, Objectives, main concepts, learning activities, follow-up activities and reference — Agree/Disagree
3. The digital form of the SLM is well-designed — Agree/Disagree

Suggestions if any:

All Sections of Content well structured as illustrated, appropriate to primary curriculum.

Signature

Name, official address of the teacher educator

E.C. Mohanan
Teacher Educator,
Govt ITE Palakkad. Kerala
Ph- 9446034578

Rating scale about the usefulness of the developed SLM in Mathematics for the prospective teachers at primary level

The details of the content outputs and structural aspects of the developed SLM are given below. Kindly rate it as per the possible response.

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1. Content is presented in sections and subsections with proper title — Agree/Disagree
2. Each sections is well-structured with clear introduction, Objectives, main concepts, learning activities, follow-up activities and reference — Agree/Disagree
3. The digital form of the SLM is well-designed — Agree/Disagree

Suggestions if any:

It is very useful to teacher students.

Signature

Name, official address of the teacher educator

AJISHA.S
A.M.S.M.M.T.T.I (W)
Koduvayur,
Palakkad.
Ph. 8301853943

Rating scale about the usefulness of the developed SLM in Mathematics for the prospective teachers at primary level

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1.Content is presented in sections and subsections with proper title	Agree/Disagree
2.Each sections is well-structured with clear introduction, Objectives, main concepts, learning activities, follow-up activities and reference	Agree/Disagree
3. The digital form of the SLM is well-designed	Agree/Disagree

Suggestions if any: SLM is useful to trainees because they uses the Content as well as pedagogy in good way

Signature

Name,official address of the teacher educator

Somasundaran P
Teacher educator
GTTI, Palakkad.

Rating scale about the usefulness of the developed SLM in Mathematics for the prospective teachers at primary level

The details of the content outputs and structural aspects of the developed SLM are given below. Kindly rate it as per the possible response.

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1.Content is presented in sections and subsections with proper title	Agree/Disagree
2.Each sections is well-structured with clear introduction, Objectives, main concepts, learning activities, follow-up activities and reference	Agree/Disagree
3. The digital form of the SLM is well-designed	Agree/Disagree

Suggestions if any: Module is good for teacher trainees due to usage of Content in foundation effectively

Signature

Name,official address of the teacher educator

Dr. Ravindran
Lecturer
DIET, Palakkad.

Rating scale about the usefulness of the developed SLM in Mathematics for the prospective teachers at primary level

The details of the content outputs and structural aspects of the developed SLM are given below. Kindly rate it as per the possible response.

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3. The digital form of the SLM is well-designed	Agree/Disagree

Suggestions if any: Developed module ~~was~~ is good for teacher trainees as well as teacher educators.

Signature

Name,official address of the teacher educator

D. Shiji
GETTI, Peruv
Pathiripala; Palakkad

Rating scale about the usefulness of the developed SLM in Mathematics for the prospective teachers at primary level

The details of the content outputs and structural aspects of the developed SLM are given below. Kindly rate it as per the possible response.

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2.Each sections is well-structured with clear introduction, Objectives, main concepts, learning activities, follow-up activities and reference	Agree/Disagree
3. The digital form of the SLM is well-designed	Agree/Disagree

Suggestions if any: The Created SLM is very useful and enhances the confidence level of teacher trainees of primary level.

Signature

Name,official address of the teacher educator

Dr. Sreekala
Sr Lecturer /
DIET Thottar
Ramanampuram

Rating scale about the usefulness of the developed SLM in Mathematics for the prospective teachers at primary level

The details of the content outputs and structural aspects of the developed SLM are given below. Kindly rate it as per the possible response.

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2.Each sections is well-structured with clear introduction, Objectives, main concepts, learning activities, follow-up activities and reference	Agree/Disagree
3. The digital form of the SLM is well-designed	Agree/Disagree

Suggestions if any: Modules are useful to teacher trainees.

Signature

Name,official address of the teacher educator

Dr. Pramod
Senior Lecturer
DIET, Palakkad.

Rating scale about the usefulness of the developed SLM in Mathematics for the prospective teachers at primary level

The details of the content outputs and structural aspects of the developed SLM are given below. Kindly rate it as per the possible response.

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2.Each sections is well-structured with clear introduction, Objectives, main concepts, learning activities, follow-up activities and reference	Agree/Disagree
3. The digital form of the SLM is well-designed	Agree/Disagree

Suggestions if any: This type of module can be utilized by trainees of Mathematics to raise their confidence level.

Rajesh R
Teacher educator (Maths)
SNITE, Kottappuram
Mannarkkad

Signature

Name,official address of the teacher educator

Rating scale about the usefulness of the developed SLM in Mathematics for the prospective teachers at primary level

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3. The digital form of the SLM is well-designed	Agree/Disagree

Suggestions if any: Modules are useful to trainees.

Basheer. P
Teacher educator
GTTI, Palakkad

Signature
Name,official address of the teacher educator

Rating scale about the usefulness of the developed SLM in Mathematics for the prospective teachers at primary level

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3. The digital form of the SLM is well-designed	Agree/Disagree

Suggestions if any: Module Created by M. Shahedha is useful to teacher trainees in Mathematics.

Dr. Jayaram VT
Senior Lecturer
DIET, Palakkad

Signature
Name,official address of the teacher educator

Rating scale about the usefulness of the developed SLM in Mathematics for the prospective teachers at primary level

The details of the content outputs and structural aspects of the developed SLM are given below. Kindly rate it as per the possible response.

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2.Each sections is well-structured with clear introduction, Objectives, main concepts, learning activities, follow-up activities and reference	Agree/Disagree
3. The digital form of the SLM is well-designed	Agree/Disagree

Suggestions if any: Modules are useful to enrich the content level of learners.

Manjusha A -
Principal in charge
RBRTTI, Kottangode

Signature
Name,official address of the teacher educator

Rating scale about the usefulness of the developed SLM in Mathematics for the prospective teachers at primary level

The details of the content outputs and structural aspects of the developed SLM are given below. Kindly rate it as per the possible response.

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2.Each sections is well-structured with clear introduction, Objectives, main concepts, learning activities, follow-up activities and reference	Agree/Disagree
3. The digital form of the SLM is well-designed	Agree/Disagree

Suggestions if any: SLM are effective to the good teaching of Maths.

R. Baby Sudha
(TE) Admn ITE
Kodwayur.

Signature
Name,official address of the teacher educator