1) Definition:

There are certain statements which are made to create new concepts from the already existing ones without leading to erroneous results. They are called **definitions.** Following are some definitions which we have already encountered :

(i) A triangle is called **equilateral** if all its sides are of same length

(ii) If $a^x=b$, then x is called the **logarithm** of b to the base a.

(iii) Two angles are called **supplementary** if their sum is 180°.

2) Concepts:

Concept is a generalized idea about the thing or object. Concepts are mental categories for objects, events, or ideas that have a common set of features. Concepts allow us to classify objects and events.

Characteristics of Concepts

i. Concepts can be operationally defined.

ii. Prescription can be defined for measuring concepts.

iii. Concepts possess quantitative nature.

iv. Acquisition of Knowledge: Concepts are formed through varied experiences, including acquisition of factual knowledge and activities.

v. Generalized Ideas: Concepts are generalized ideas suggested to the individual through objects and symbols.

vi. Learning by Activity: Concepts learning is facilitated by learning through activity in a variety of situations and in a variety of contexts.

vii. Abstraction to Classify Words: A concept is an abstraction to classify words, and feelings, which have certain common qualities.

Uses of Concepts

i. Reference frame for understanding.

ii. Medium for discussion and argument.

iii Elements in Laws and Theories.

Mathematical Concepts

Mathematical concepts are those concepts taken from a mathematicized world of ideal and precise objects, and it is a realm in which actions exist as calculations. Such concepts are often justifiable by empirical evidence, but some cannot be and they find justification as coherent parts of a fruitful theory. Mathematical concepts are taken seriously only insofar as they yield new understanding of the world of our experiences.

3) Generalization:

In mathematics, generalization can be both a process and a product. When one looks at specific instances, notices a pattern, and uses inductive reasoning to conjecture a statement about all such patterns, one is generalizing. The symbolic, verbal, or visual representation of the pattern in your conjecture might be called a generalization.

When a student notices that the sum of an even and an odd integer always results in an odd integer, that student is generalizing. Generalizations such as this allow students to think about computations independently of the particular numbers that are used. Without this, and many other generalizations made in mathematics from the early grades, all work in mathematics would be cumbersome and inefficient.

Mason, et al., 2011, Defines,

- Generalizations are the lifeblood of mathematics."
- Generalizing is the process of "seeing through the particular" by not dwelling in the particularities but rather stressing relationships… whenever we stress some features we consequently ignore others, and this is how generalizing comes about."

By examining examples such as:

$a^2 \times a^3 = (a \times a) \times (a \times a \times a) = a^5$
$a^3 \times a^4 = (a \times a \times a) \times (a \times a \times a \times a) = a^7$ and so on

One can conclude that: $\mathbf{a^m \times a^n = a^{m+n}}$

…thus generalizing to all cases for a specific domain for the base “a” and the exponents “m” and “n.”

4) Formula:

The formula is a fact or a rule written with mathematical symbols. It usually connects two or more quantities with an equal to sign. When you know the value of one quantity, you can find the value of the other using the formula.

Various dictionaries explain the meaning of formula as a noun in different ways:

- A group of symbols that make a mathematical statement.
- Directions for making something.
- A conventionalized statement expressing some fundamental principle.
- Statement – a message that is stated or declared; a communication (oral or written) setting forth particulars or facts etc; for example, "according to his statement he was in London on that day."
- A representation of a substance using symbols for its constituent elements.
- Something regarded as a normative example; "the convention of not naming the main character"; "violence is the rule not the exception"; "his formula for impressing visitors."
- A liquid food for infants.
- (Mathematics) a standard procedure for solving a class of mathematical problems; "he determined the upper bound with Descartes' rule of signs"; "he gave us a general formula for attacking polynomials."

Examples of formula:

- **Perimeter of rectangle** = 2(length + width)

  If the length and width of a rectangle are 'a' units and 'b' units respectively, the formula of its perimeter is: $P = 2\,(a + b)$
- **Area of rectangle** = length × width

  If the length and width of a rectangle are 'a' units and 'b' units respectively, the formula of its area is: $P = a \times b$
- **Perimeter of square** = 4 × side length

If the length of the side of a square is ‘a’ units, then its perimeter P is the sum of all its sides. P = a + a + a + a , so P = 4a

- **Area of square** = Side length × side length

  If the side length of the square is a units; then its area is: Area = a × a = a^2
- **Volume of cuboid** = length × width × height
- **Profit** = Selling price - cost price
- **Loss** = Cost price - selling price
- **Non examples:**
  1. 2x - 3 = 6
  2. x + y = 10
  3. 3x - 8x + 9x = 17. These are equations and not formula.

Fun Facts

- The first formula was invented between 1800-1600 BC.
- You find formulas not just in Mathematics but in Science as well.

5) LAW

A law is an important insight about the nature of the universe. A law can be experimentally verified by taking into account observations about the universe and asking what general rule governs them. Laws may be one set of criteria for describing phenomena such as Newton's first law (an object will remain at rest or move at a constant velocity motion unless acted upon by an external force) or one equation such as Newton's second law (F = ma for net force, mass, and acceleration).

Laws are deduced through lots of observations and accounting for various possibilities of competing hypotheses. They don't explain a mechanism by which a phenomena occurs, but, rather, describe these numerous observations. Whichever law can best account for these empirical observations by explaining phenomena in a general, universalized manner are the law that scientists accept. Laws are applied to all objects regardless of scenario but they are only meaningful within certain contexts.

A law is a universal principle that describes the fundamental nature of something, the universal properties and the relationships between things, or a description that purports to explain these principles and relationships. **Example**

The **Basic Laws of Algebra** are the associative, commutative and distributive laws. They help explain the relationship between number operations and lend towards simplifying equations or solving them.

Property Name	Definition	Example
Commutative Law For Addition	$a+b=b+a$ The arrangement of addends does not affect the sum.	If $2+3=5$, then $3+2=5$
Commutative Law For Multiplication	$a*b=b*a$ The arrangement of factors does not affect the product.	If $(2)(3)=6$, then $(3)(2)=6$
Associative Law For Addition	$(a+b)+c=a+(b+c)$ The grouping of addends does not affect the sum.	If $(2+3)+4=5+4=9$, then $2+(3+4)=2+7=9$
Associative Law For Multiplication	$(a*b)*c=a*(b*c)$ The grouping of factors does not affect the product.	If $(2*3)*4=(6)4=24$, then $2*(3*4)=2(12)=24$.
Distributive Law	$a(b+c)=(a*b)+(a*c)$ Adding numbers and then multiplying them yields the same result as multiplying numbers and then adding them.	If $2(3+4)=2(7)=14$, then $2(3)+2(4)=6+8=14$

6) Rules

For a calculation that has only one mathematical operation with two numbers, it is a simple case of either adding, subtracting, multiplying or dividing to find your answer.

But what about when there are several numbers, and different operations? May be you need to divide and multiply, or add and divide. What do you do then?

Fortunately, mathematics is a logic-based discipline. As so often, there are some simple **rules** to follow that help you work out the order in which to do the calculation. These are known as the ‘Order of Operations’.

BODMAS is a useful acronym that tells you the order in which you solve mathematical problems. It's important that you follow the **rules** of BODMAS, because without it your answers can be wrong.

The BODMAS acronym is (short form) for:

- Brackets (parts of a calculation inside brackets always come first).

- Orders (numbers involving powers or square roots).
- Division.
- Multiplication.
- Addition.
- Subtraction

7) Properties

In mathematics, a property is any characteristic that applies to a given set.Rigorously, a property p defined for all elements of a set X is usually defined as a function $p: X \rightarrow$ {true, false}, that is true whenever the property holds; or equivalently, as the subset of X for which p holds; i.e. the set $\{x \mid p(x) = \text{true}\}$; p is its indicator function. However, it may be objected that the rigorous definition defines merely the extension of a property, and says nothing about what causes the property to hold for exactly those values.

There are four basic properties of numbers: commutative, associative, distributive, and identity. You should be familiar with each of these. It is especially important to understand these properties once you reach advanced math such as algebra and calculus etc.,

8) Axioms

There are certain statements which are assumed to be true. These statements are called **axioms.** Following are some axioms which we come across in Geometry and Algebra.

(i) There is exactly one and only one straight line passing through two given points.
(ii) For any two real numbers, $x + y$ and xy are real numbers.
(iii) If n is a natural number, then $n + 1$ is also a natural number.
(iv) A straight line segment has one and only one mid point.
(v) An angle has one and only one bisector.

9) Structures

Mathematics is a branch of science. Science is the systematic study of knowledge. The structure of mathematics is nothing but the structure of science. The structure of science can be compared to the framework of a building under construction. A framework of a building consists of a foundation, vertical pillars and horizontal beams. The foundation of the framework is comparable to broad generalization and principles of science. The vertical pillars to the theories and the horizontal beams to the methods for processes of science. The facts are comparable to building materials i.e., stone, bricks and concrete etc. In the analogy, the vertical pillars and the horizontal beams of science are subject to alteration on the basis of empirical tests. It should be noted that this analogy of a building under construction is to facilitate understanding of the structure of science.

10) Constructions

In the general sense, construction means to build something. But in geometry it has a special meaning. Here, construction is the act of drawing geometric shapes using only a compass and straightedge. No measuring of lengths or angles is allowed.

The word construction in geometry has a very specific meaning: the drawing of geometric items such as lines and circles using only compasses and straightedge or ruler. Very importantly, you are not allowed to measure angles with a protractor, or measure lengths with a ruler.

The Greeks formulated much of what we think of as geometry over 2000 years ago. In particular, the mathematician Euclid documented it in his book titled "Elements", which is still regarded as an authoritative geometry reference. In that work, he uses these construction techniques extensively, and so they have become a part of the geometry field of study. They also provide insight into geometric concepts and give us tools to draw things when direct measurement is not appropriate.

11) Graphs

Descartes is usually credited with the invention of graphs, but in many ways the Greeks anticipated him and if they had possessed a better idea of algebra it is probable, that they would have prepared the method of graphs. A graph is a geometrical picture showing arithmetical and algebraic relations.

The greater stress on graphical work is now accepted every where. Facts are presented through pictures, curves or graphs in the newspapers or advertisements.

The course of an illness, the constitution of the population a generation or two hence, the efficiency of a petrol engine, all these and many more can be brought to life by means of a suitable diagram.

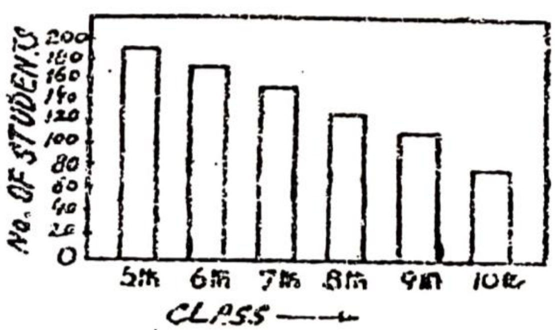
These graphs as they are called, belong to the A, B, C of the subject. Later they become a powerful tool in the advanced mathematical treatment of the most difficult problems.

How to Introduce Graphs. No doubt we are concerned with algebraic graphs in algebra, but it is essential that considerable attention should be paid towards the reading and drawing of graphs from purely arithmetical data before any algebraic notation is introduced.

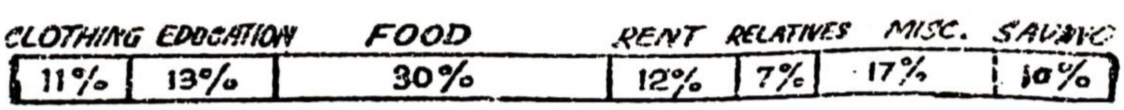
In the beginning as the pupils take considerable time in drawing graphs, it is quite desirable and advisable that considerable practice should be given is reading the graphs already drawn in the books or drawn on the blackboard by the teacher A number of questions should be put to the students regarding the graphs so as to enable them to read the graphs intelligently This will ultimately help them in understanding the questions in graphs and to draw them intelligently. The graphing of statistics should come first.

First of all bar or column graphs should be introduced. They are easy to understand. Thus graphs showing the exports and imports, family consumptions, rainfall of a place in different months, results to a school, etc., etc., are some of the examples of simple graphs to be shown to the students in the early stages of introducing the topic. When sufficient intimacy is found among the students with the graphs, they may be asked to draw such graphs while given the required data for them. Before they proceed with the actual task of drawing the graphs, the scales should be determined. Here are some examples of graphs to be tackled in the beginning as mentioned before :

Column Graph showing the number of students in a high school



Bar Graph of a family budget



Circle Graph of agriculture vs. other means of occupation in India.

Later on the arithmetical work should eventually lead to the construction of graphs in which the table of values obtained by calculations or from some simple experiment like measuring the length of a rubber cord from which various weights have been suspended. The law implied in this experiment can now be explicitely stated as an algebraic law of the type $L=a+bW$ where L=length of the cord when some weight is suspended, and W=weight and a, b are constants.

Coming to the drawing of graphs it may be added that after sufficient practice in arithmetical work we may turn to algebraic expressions. First of all we should take the equations like $x=5$; $y=3x$; $5x-4y-7=0$ and later on like $x^2+y^2=36$, $(x-3)^2+(y-2)^2=25$, $y=4x^2$ and so on.

Following are some of the points showing their importance.

(1) The graph makes an immediate appeal to the eye. The visual image is one, above all others, which can most easily be remembered, analysed and interpreted.

(2) The graph gives a picture of the variation of one quantity with another. Its primary use is to exhibit to the eye a series of simultaneous values of two quantities. It should give the idea of the interdependence of two related quantities ; it should give idea of continuity. It often enables the investigator to discover whether there is any variation or correlation or not. It is the best means by which the function is taught and symbolised.

(3) It may be used as a ready-reckoner or a means of making quick conversions from one measurement to another and so on.

(4) The study of graphs is very concrete and thus counteracts somewhat the tendency of school algebra from becoming mechanical application of known rules.

(5) The graphic representations are at present so widely used in daily papers, magazines etc, that a certain familiarity with these devices is part of general knowledge.

(6) It enables the students to solve some difficult problems which otherwise they cannot ; as solution of higher equations and transcendental equations, etc.

(7) The students acquire a clear notion about functionality—a very important concept

(8) Students feel interested in it as it delivers its message in a form readily taken in by the eye.

(9) It serves as display work.

(10) It can be used to bring out and express the law that underlies the diversity of a number of concrete facts.

(11) It gives the idea of continuity and self-consistency of mathematics.

(12) A graph gives excellent opportunities for insisting upon the 'great school virtues' of neatness, carefulness and accuracy.

(13) The graph also gives the pupil an opportunity of criticising his own work ; a graph that suddenly moves off in an unexpected direction or a point that spoils the smoothness of a curve soon leads the pupil to suspect a mistake.

(14) The graphic representation of facts appeals to the aesthetic sense.

(15) A graph is simply a visible form of the equation just as written words is a visible form of the spoken word.

(16) It gives a simple scope for statistical treatment.

(17) Graphs interest students and are easily understood. They are very faithful in developing and consolidating idea.

(18) There is the interesting character and the practical importance of graphical devices.

(19) There is the simplicity and power of the graph for presenting data in a condensed, understandable and striking way.

(20) This mode of representing variables is used a great deal in other sciences.

(21) A graph is pictorial representation of some relation given in the form of a verbal problem or an equation or a formula. It is a device of saving many laborious computations.

(22) By graphs many mathematical facts become visible to the eye, which otherwise would remain obscure.

(23) The graph is an effective means of presenting data, making comparisons, and depicting relations ; it offers untold opportunities for free play of the imagination, for the application of simple or ingenious constructive abilities and for the development of an enthusiastic interest in mathematical method and a more intelligent understanding of fundamental procedures on the part of all those becoming proficient in its construction and interpretation.

(24) The introduction of statistical work in graphs and simple tabulations reflects the double aim of making elementary mathematics of practical everyday use at every stage and of ensuring that pupils will be able to follow sociological problems in after-school days. It teaches mathematical methods and at the same time brings the people into contact with information in science, social studies and every day life.

The points plotted in different quadrants on a graph paper are signed numbers. Although a graph is drawn from a few points, it is a locus, and shows continuity.

The most frequent objections of teachers to the use of graphical methods are that graphs are unreliable because pupils do not make them accurately; that the work consumes too much time; that it requires an equipment which pupils fail to bring to class because it is not in daily use. The teacher should give careful attention to these criticisms.

12) Operations

The mathematical "operation" refers to calculating a value using operands and a math operator. The symbol of the math operator has predefined rules to be applied to the given operands or numbers.

A mathematical expression is a set of numbers and operations. The elements of a math expression performing a math operation are:

Operands – The numbers used for an operation are called operands. Based on the type of operation, different terms are assigned to the operands.

Operator – The symbol indicating a math operation is an operator, for example:

- + for addition
- - for subtraction
- × for multiplication
- ÷ for division
- = for equal to, indicates the equivalence, that is the left hand side value is equal to the right hand side value.

A mathematical process. The most common are add, subtract, multiply and divide (+, −, ×, ÷). But there are many more, such as squaring, square root, logarithms, etc. If it isn't a number it is probably an operation. **Example: In 25 + 6 = 31 the operation is add**

13) Procedures and Processes

Procedure

In general, a procedure is a sequence of mathematical operations carried out in order. A solution procedure is a sequence of steps that, when taken, solves an equation.

1. Example: Procedures can also be visualized as flowcharts, where each step is connected by arrows.
2. Example: Your multiplication and division operations also have procedures you need to follow. Multiplication can be likened to your addition in that you multiply from left to right and you can multiply your numbers in any order. For example 2 * 3 * 4 is the same as 3 * 4 * 2 both equal.

Processes

Mathematical Process: mathematics calculation by mathematical method, “the problem at the end of the chapter demonstrated the mathematical processes involved in the derivation”, “they were learning the basic operations of arithmetic”

These processes focus on: communicating, making connections, mental mathematics and estimating, problem solving, reasoning, and visualizing along with using technology to integrate these processes into the mathematics classroom to help children learn mathematics with deeper understanding.

14) Axioms and Postulates

Axioms. An **axiom** is a general mathematical truth accepted without proof, *i.e.*, the whole is greater than the part ; if equals be added to or subtracted from equals the results are equal ; two things equal to the same thing, are equal to each other. If equal quantities are multiplied (divided) by equal quantities, the results are equal except that a divisor cannot be zero.

Two quantities which coincide with each other are equal. If two distinct points lie on a plane, then every point of the line lies in that plane.

Postulates. Suppositions without proof are **postulates.** In geometry self-evident truths are postulates, *e.g.*

1. It is possible to draw a line by joining any two points.
2. Two straight lines cannot intersect in more than one point.
3. A terminated straight line in either direction can be produced both ways.
4. A st. line has one mid-point, and only one.
5. An angle can be bisected by one line and only one.
6. It shall be possible to draw a circle with given centre and passing through a given point.
7. All right angles are equal.
8. Any geometric figure can be moved without changing its size or shape.

Axioms should be consistent, free from ambiguity and present no conflict with established knowledge or observable facts. They are like the conventions and rules of a game. We agree to abide by them and play accordingly. They are accepted as true because of their conformity with common experience and sound judgment and they are in no sense 'self-evident' truths. The entire subject of geometry rests upon axioms, postulates and definitions and hence these are frequently called the bases of geometry.

15) Theorems and their converse

Theorem

A statement until it is proved or disproved is called a conjecture. A conjecture, if it is proved, becomes a theorem. A conjecture, it is disproved, becomes a false statement. Thus, a statement which has been already proved to be true is called a theorem. If a statement holds true in a particular case, then we say that the verification of the statement is made.

A theorem is a statement that can be demonstrated to be true by accepted mathematical operations and arguments. In general, a theorem is an embodiment of some general principle that makes it part of a larger theory. The process of showing a theorem to be correct is called a proof.

Examples:

1. If two sides of the triangle are equal, then the angles opposite to them are equal
2. The sum of three angles of the triangle is equal to two right angles.

Converse theorem

A converse of a theorem is a statement formed by interchanging what is given in a theorem and what is to be proved. It is obtained by interchanging the hypothesis and conclusion.

For example,

Case 1: Even if the original statement is true. The following statement is true all the time:

- The isosceles triangle theorem states that if two sides of a triangle are equal then two angles are equal.
- **In the converse**, the given (that two sides are equal) and what is to be proved (that two angles are equal) are swapped, so the converse is the statement that if two angles of a triangle are equal then two sides are equal.

Case 2: However, the converse may not be true all the time :(the converse can be proved as another theorem, but this is often not the case.)

16) Propositions

- A **proposition** is a theorem of lesser importance. This term sometimes connotes a statement with a simple proof, while the term **theorem** is usually reserved for the most important results or those with long or difficult proofs. Some authors never use "proposition", while some others use "theorem" only for fundamental results. In classical geometry, this term was used differently: In Euclid's Elements (c. 300 BCE), all theorems and geometric constructions were called "propositions" regardless of their importance.

- A proposition is a mathematical statement such as "3 is greater than 4," "an infinite set exists," or "7 is prime."

- An axiom is a proposition that is assumed to be true. With sufficient information, mathematical logic can often categorize a proposition as true or false, although there are various exceptions (e.g., "This statement is false").

The propositions in geometry are of two kinds, *viz.* Theorems and Problems.

A theorem is a statement to be proved.

A problem is a geometric construction to be made or a computation to be performed.

17) Proofs

A rigorous mathematical argument which unequivocally(clearly) demonstrates the truth of a given proposition. A mathematical statement that has been proven is called a theorem. Types of proof:

- Direct proof
- Indirect proof or contradiction
- Proof by counter examples
- Geometrical proof technique
- Proof by construction

18) Problems in Mathematics

A problem is an exercise that contains an element of novelty. The essential feature of a problem is that there should be something fresh and unfamiliar about it.

A problem is an exercise whose solution is desired. Mathematical "problems" may therefore range from simple puzzles to examination and contest problems to propositions whose proofs require insightful analysis.

Types of Problems:

- Puzzle problems
- Catch problems
- Unreal problems
- Real problems

19) Critical analysis of content course of Standard VI to X Mathematics.

The National Council of Teachers of Mathematics (NCTM), the world's largest organization devoted to improving mathematics education, is developing a set of mathematics concepts, or standards, that are important for teaching and learning mathematics. There are two categories of standards: thinking math standards and content math standards. The thinking standards focus on the nature of mathematical reasoning, while the content standards are specific math topics. Each of the activities in this booklet touches one or more content areas and may touch all four thinking math areas.

The four thinking math standards are problem solving, communication, reasoning, and connections. The content math standards are estimation, number sense, geometry and spatial sense, measurement, statistics and probability, fractions and decimals, and patterns and relationships. We have described them and then provided general strategies for how you as a parent can create your own activities that build skills in each of these areas.

Thinking mathematics

Problem solving is key in being able to do all other aspects of mathematics. Through problem solving, children learn that there are many different ways to solve a problem and that more than one answer is possible. It involves the ability to explore, think through an issue, and reason logically to solve routine as well as nonroutine problems. In addition to helping with mathematical thinking, this activity builds language and social skills such as working together.

Communication means talking with your children and listening to them. It means finding ways to express ideas with words, diagrams, pictures, and symbols. When children talk, either with you or with their friends, it helps them think about what they are doing and makes their own thoughts clearer. As a bonus, talking with children improves their vocabulary and helps develop literacy and early reading skills as well.

Reasoning is used to think through a question and come up with a useful answer. It is a major part of problem solving.

Connections: Mathematics is not isolated skills and procedures. Mathematics is everywhere and most of what we see is a combination of different concepts. A lot of mathematics relates to other subjects like science, art, and music. Most importantly, math relates to things we do in the real world every day. Connections make mathematics easier for children to understand because they allow children to apply common rules to many different things. What parents can do:

- Ask children to think about and solve problems that arise in your everyday activities. For example, ask children to help you put the groceries away. They will practice sorting—the cereal boxes and the soup cans—and experiment with relative size and shape and how the big boxes take up more room than the smaller ones.

- Look for mathematics in your everyday life and don't worry about what the particular aspect of mathematics might be. Something as simple as pouring water into different sized cups and thinking about which cup will hold more is a low-key activity that actually involves estimation, measurement, and spatial sense.

Content mathematics

Patterns and relationships: Patterns are things that repeat; relationships are things that are connected by some kind of reason. They are important because they help us understand the underlying structure of things; they help us feel confident and capable of knowing what will come next, even when we can't see it yet. Patterns and relationships are found in music, art, and clothing, as well as in other aspects of math such as counting and geometry. Understanding patterns and relationships means understanding rhythm and repetition as well as ordering from shortest to longest, smallest to largest, sorting, and categorizing.

Number sense and numeration: Number sense is much more than merely counting, it involves the ability to think and work with numbers easily and to understand their uses and relationships. Number sense is about understanding the different uses for numbers (describe quantities and relationships, informational tools). Number sense is the ability to count accurately and competently, to be able to continue counting—or count on—from a specific number as well as to count backwards, to see relationships between numbers, and to be able to take a specific number apart and put it back together again. It is about counting, adding, and subtracting. Counting and becoming familiar with numbers will help your children understand all other aspects of math.

Geometry and spatial sense: Geometry is the area of mathematics that involves shape, size, space, position, direction, and movement, and describes and classifies the physical world in which we live. Young children can learn about angles, shapes, and solids by looking at the physical world. Spatial sense gives children an awareness of themselves in relation to the people and objects around them.

Measurement: Measurement is finding the length, height, and weight of an object using units like inches, feet, and pounds. Time is measured using hours, seconds, and minutes. Measurement is an important way for young children to look for relationships in the real world. By practicing measurement your child will learn how big or little things are and how to figure that out.

Fractions: Fractions represent parts of a whole. A very young child will see something cut into three pieces and will believe that there is more after cutting it than before it was cut. This is typical and should not cause alarm in parents. It is one example of how children and adults think differently!

To understand fractions, children need to think about:

- what the whole unit is,
- how many pieces are in the unit, and
- if the pieces are the same size.

Estimation: To estimate is to make an educated guess as to the amount or size of something. To estimate accurately, numbers and size have to have meaning. Very young children will not be able to estimate accurately, because they are still learning these concepts. They first need to understand concepts like more, less, bigger, and smaller. When children use estimation, they learn to make appropriate predictions, to obtain reasonable results, and they learn math vocabulary such as "about," "more than," and "less than."

It is important for children to learn:

1. how to use estimation,
2. when the technique is appropriate, and
3. when the solution is reasonable.

Statistics and probability: Using graphs and charts, people organize and interpret information and see relationships. Graphing is another way to show and see information mathematically. Charts, including calendars, can be used to organize everyone's weekly activities. Even older children in elementary school may find it hard to keep track of calendars, but, when adults use them with children, calendars can be helpful tools to learning and understanding how we organize information.

Statistics, like batting averages in baseball, tell stories about our world. We know which player is having the best season and which batter is most likely to hit a home run. Probability tells the likelihood of something occurring. These are some facts review on content course of mathematics.

20) Basic concepts in Secondary School Mathematics.

At the secondary stage, students begin to perceive the structure of Mathematics, as a discipline. Pure rote-learning until facts are memorised mechanically, is to be avoided and opportunities to be provided to relate conceptual knowledge accompanied with procedural knowledge.

Examples and activities to be provided for familiarising various concepts through the characteristics of mathematical communication, carefully defined terms and concepts, the use of symbols to represent them, and precisely stated propositions and proofs justifying propositions.

Students develop their familiarity with algebra, Mathematical modelling, data analysis and interpretation during this stage.

Algebra and arithmetic can be correlated with geometry.

Algebra and geometry can be correlated with trigonometry.

Attention must be paid also to the relationship of Mathematics with other subjects such as physics, chemistry, biology, geography or social sciences.