Swamy Vivekananda Vidya Samsthe(R) Trust, Shikaripur
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II Semester

PSS- Mathematics
Unit-1
Meaning and Nature of mathematics

By

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II Semester
Introductory Class

By

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BACHELOR OF EDUCATION DEGREE COURSE

SEMESTER-2
PEDAGOGY OF SCHOOL SUBJECT (PSS1A/2A)
MATHEMATICS

Marks: 75+25=100

INDEX

Objectives:

On completion of course the student teacher will be able to –

- Identify the concepts, definitions, axioms, generalizations, relations, structures, problems etc., of the secondary school mathematics.

- Understand the nature, structure, scope and relations with other disciplines.

- Understand the aims and objectives of teaching mathematics.

- Identify the learning experiences appropriate to the objectives of teaching secondary school mathematics.

- Prepare the year plan, unit plan, activity oriented lesson plans for effective classroom communication.

UNIT1: MEANING, NATURE AND SCOPE OF MATHEMATICS

4.1 Meaning and definition of mathematics.

4.2 Nature of mathematics-

Mathematics as a language,
mathematics as a science of number,
science of logical thinking, and
interpreter of physical phenomenon.

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Continued,,,

4.3 Scope of mathematics: - Mathematics in day to day life, various fields, different vocations.

4.4 Relationship with school subjects and other disciplines

UNIT-2 AIMS AND OBJECTIVES OF TEACHING MATHEMATICS

1. Aims/ Values – Meaning and importance practical (utilitarian ,preparatory) disciplinary, cultural, Recreational, /aesthetic values.

2. Objectives of teaching mathematics- knowledge understanding, application, skill, interest, attitude, appreciation.(NCERT version)

3. Formulation of instructional objectives in behavioral terms (criteria wise)

UNIT-3:- INSTRUCTIONAL DESIGN FOR MATHEMATICS.

a. Lesson plan- meaning, importance, steps, and format

b. Unit plan- meaning steps, format

c. Resource unit meaning, steps, format

d. Year plan- meaning, principles, and format.

UNIT-4:- METHODS AND APPROACHES OF TEACHING MATHEMATICS

- Learner centred approaches – inductive, deductive, analytic, synthetic, laboratory method.
- Activity centred approaches – Heuristic approach, project method, programmed instruction.
- Devices in teaching Mathematics- oral work written work, drill work and review.
- Models of teaching – Suchmann's enquiry training models - Bruner'sconcept attainment model.

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II Semester

SEMESTER-2

PEDAGOGY OF SCHOOL SUBJECT
MATHEMATICS (PSS1A/2A)

Topic: Meaning and Nature of Mathematics

By

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Etymological Meaning of Mathematics

The term MATHEMATICS is derived from the two Greek words manthanein which means learning and techne means an art or technique.

Therefore Mathematics means the art of learning related to disciplines.

Definitions of Mathematics

According to Locke

Mathematics is the way to settle in the mind a habit of reasoning.

According to Kant

Mathematics is the indispensable instrument of all Physical researches.

According to Gauss

Mathematics is the queen of Science and arithmetic is queen of Mathematics.

According to Lindsay

Mathematics is the language of Physical Sciences and certainly no marvelous language was ever created by the mind of man.

According to Bacon

Mathematics is the gateway and key to all sciences.

According to J B Shaw

Mathematics is engaged, in fact, in the profound study of art and the expression of beauty.

- According to New oxford english dictionary

Mathematics- in a strict sense-is the abstrct science, which investigate deductively the conclusions implicit in the elementary conception of spatial and numerical relations.

According to Galileo

Mathematics is the language in which God has written the Universe.

According to Comte

All scientific education which does not commence with Mathematics is of necessitively defective at its foundations

- Mathematics is the science of number and space
- Mathematics is the the science of measurement, quantity and magnitude

From the above definitions , it can be seen that

- Mathematics is a science of number and Space
- Mathematics has its own language – signs, Symbols, terms, and operations.
- Mathematics involves mans high Cognitive powers.
- Mathematics is more about forming generalizations, seeing relationships and developing logical thinking and reasoning.
- Mathematics is the tool specially designed for dealing with abstract concept of any kind.
- Mathematics helps in solving the problem of ourlife and disclosing the realm of nature

Nature of Mathematics

The nature of Mathematics can be made explicit by analyzing the characteristics of Mathematics,

- Mathematics is a Science of discovery

Mathematics is the discovery of relationships and the expressions of these relationships in symbolic form in words, in numbers, in letters, by diagrams,or by graphs.

Mathematics gives an early opportunity to make independent discoveries.

Solving of Mathematical problem is no way less than making discovery.

Mathematics- An intellectual game

Mathematics can be treated as an intellectual game with its own rules and without any relations to external criteria. From this view point, Mathematics is mainly a matter of Puzzles, Paradoxes and problem solving – A sort of mental Exercises

Mathematics- The art of drawing Conclusions

Mathematics permits the learner to begin with simple and very easy conclusions to pass in well graded sequence to very difficult ones as the earlier ones are mastered.

Mathematics conclusions are certain.

Mathematics- As a tool subject

Mathematics has its integrity, its beauty, its structure and many other features that relate to mathematics as an end in itself and it is one of the important tool subject

Mathematics is an experimental, inductive science

In Mathematics the generalizations follow as outcomes of the observations of mathematical phenomena and relationships. It is based on the principal that if a relationships holds good for some particular cases it holds good for any similar cases and hence the relationship can be generalized, such a process is called inductive reasoning.

- Mathematics requires the applications of rules and concepts to new situations.
- Mathematics is logic.
- Mathematics provides framework for solving problems.
- Mathematics is the powerful tool in the hands of the learner.

- The study of mathematics develops logical thinking and reasoning, critical mind and creative thinking.

- Mathematics provides clear understanding of laws of nature.

- Mathematics learning inculcates a good deal of self – reliance, self confidence, tolerance and open mindedness

Home work

1. Explain the meaning of Mathematics?

2. Discuss the Nature of Mathematics in detail.


Thank You
For Your Attention

Thank
YOU

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II Semester

PEDAGOGY OF SCHOOL SUBJECT

Mathematics (PSS1A/2A)

Topic : Mathematics as a language and Interpreter of physical phenomena

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Kumdvathi College of Education
Shikaripura

INDEX

- Mathematics as a language
- Interpreter of physical phenomena

Language is a vehicle for Communication

- Galileo

  Mathematics is the language in which god has written the Universe

- Lindsay

  Mathematics is the language of physical science and certainly no marvelous language was ever created by the mind of man.

Mathematics as a language

The **language of mathematics** is the system used by a mathematician to communicate mathematical ideas among themselves.

This language consists of a substrate of some natural language (for example English) using technical terms and grammatical conventions that are peculiar to mathematical discourse, supplemented by a highly specialized symbolic notation for mathematical formulas.

Introduction :-

- **Mathematical language and symbolism:-**

Mathematics has its own language, its own tools and mode of operations.

The language for the communication of mathematical ideas is largely in terms of symbols and words which everybody cannot understand.

- . Brevity is the soul of wisdom

In Mathematics, we express lengthy statements(shortness and conciseness) in a very brief form by using various symbols. Thus, Mathematics has a peculiar language in which symbols occupy the most important position.

- Mathematics is free from verbosity
- Mathematical language helps the people to express their ideas or things in exact form by using notations, Symbols and formula.
- The progress of mathematics depends on the enormous use of Mathematical language and symbolism
- A good student of Mathematics must be in position to appreciate the precision, brevity, logic, sharpness and beauty of its peculiar language.

- Mathematical language is just like any other language and there is no need for translating this language into ones own mother tongue.
- The symbols of Mathematics constitute a language which is gradually developed by and for the pupil.
- Long periods of tracing with patience and endurance are needed to make the students feel at home with this language. The training that mathematics provided in the use of symbols is an excellent preparation for other sciences.

Example

The commutative law of addition and multiplication in real number system can be stated in the verbal form as : ‘the addition and multiplication of two real number is independent of the order in which they are combined.’

It can be stated in concise form as :

‘a + b = b + a and

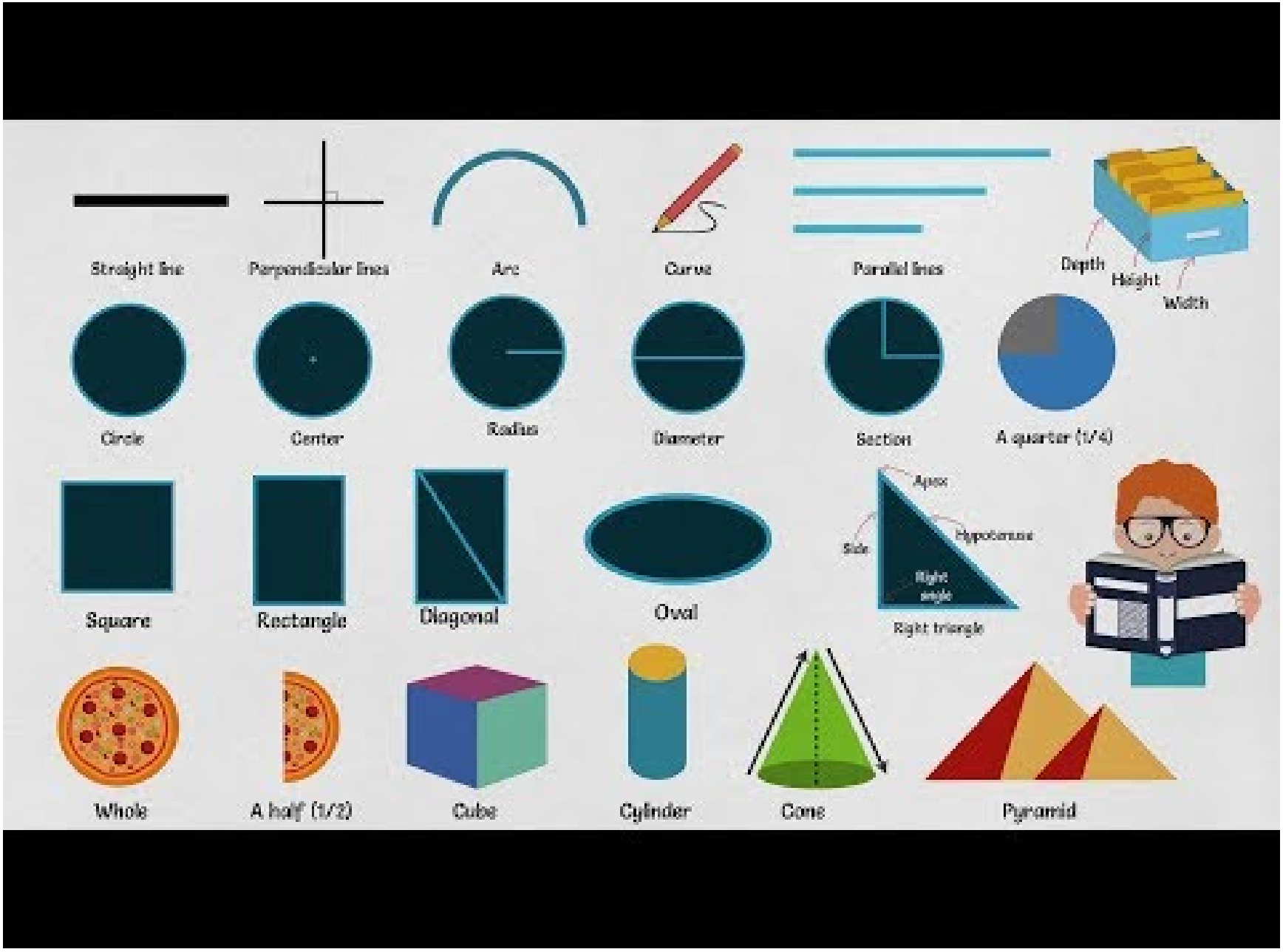
a * b = b * a, ¥ a , b € R.’

Example,

If we wish to say that the sum of the squares of two sides of a right angled triangle is equals to the square of hypotenuse, then we can write it in mathematical language as,

$$c2 = a2 + b2.$$

The symbols are used to make the mathematical results exact and readily useful. The skill in using mathematical symbol comes handy in solving many a complicated problems. It is a must for learning of higher Mathematics. These days it is also essential for study of various branches of sciences because most of the results of scientific inventions and discoveries are stated through mathematical language, making use of symbols.


Straight line
Perpendicular lines
Arc
Curve
Parallel lines
Depth
Height
Width
Circle
Center
Radius
Diameter
Section
A quarter (1/4)
Square
Rectangle
Diagonal
Oval
Apex
Side
Hypotenuse
Right angle
Right triangle
Whole
A half (1/2)
Cube
Cylinder
Cone
Pyramid

Mathematics Symbols

+	plus	=	is equal to	⇔	is equivalent to
−	minus	≠	is not equal to	⇒	implies
×	multiplied by	~	is similar to	θ	theta
÷	divided by	≅	is congruent to	∅	empty set
±	plus or minus	∞	infinity	Δ	triangle or delta
>	is greater than	≥	is greater than or equals	∀	for all
<	is less than	≤	is less than or equals	π	pi; 3.14159

∫	integral	!	factorial	⊥	perpendicular
∩	intersection of two sets	∴	therefore	∃	exists
∪	union of two sets	√	Square root of	%	percent

$\overleftrightarrow{AB}$	line AB	∟	right angle	{ }	braces (grouping)
$\overline{AB}$	segment AB	∠	angle	[ ]	brackets
$\overrightarrow{AB}$	ray AB	Σ	sum of	( )	parentheses (grouping)

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Some of the important and familiar symbols used in Mathematics are given below :

- l l - Parallel lines
- > - greater than
- < - less than
- ≡ - congruency
- √ - Square root
- ∟ - Angle
- Σ - Summation
- + - addition
- - - subtraction
- x - Multiplication
- / - Division
- % - percentage and so on.

It is highly impossible to prepare a comprehensive list of at the mathematical symbols. Anyone, who wants to read and communicate effectively in mathematical language, has to be well versed in the mathematical symbols and their definite uses. The misunderstanding of symbols, lead students to lose interest in the subject which appears to them, dull and boring. So, teachers should train the pupil in the correct use of mathematical language and symbols. They should learn to appreciate the beauty, precision and exactness of mathematical language and symbols and should understand that, "Wherever there is a structure, relationship, regularity, systematic variation, there is Mathematics".

Mathematics as a science of measurement and quantification(Numbers):

- Measurement is the assignment of a numerical value to an attribute of an object, or the assignment of a number to a characteristic of a situation.
- Mathematics is a science of measurement because measurement is an outcome of a sequence of operations carried out under a set of specified, realizable and experimental conditions.
- Measurement is fundamental to the teaching and learning of mathematics because it provides a natural way to the development of number concepts and also to the application of mathematics over a very wide field.

- Mathematics in a realistic setting provides a logical way in teaching mathematics, in real life context in which number concepts are applied and used.
- Measurement as a mathematical concept may be more easily accessible to students because it exists all around them in their everyday lives.
- Students can learn to perform accurately a number of measuring procedures and use the results to make judgments about the magnitude of quantities.
- One of the most obvious features of mathematics is its fixation with putting numbers to things, by quantification using mathematical formulae.

In mathematics, magnitudes and multitudes are two kinds of quantity to be measured and they are commensurable with each other. Setting the units of measurement,

Mathematics also covers such fundamental quantities as space (length, breadth and depth) and time, mass and force etc., The topics such as numbers, number systems, with their kinds and relations, fall into the number theory.

Geometry studies the issues of spatial magnitudes: straight line (their length, and relationships as parallels, perpendiculars, angles) and curved lines (kinds and number and degree) with their relationships (tangents, secants, and asymptotes). Also it encompasses surface and solids, their transformation, measurements and relationships.

Mathematics is the Interpreter of physical phenomena

In Physics, every rule and principle takes the mathematical form ultimately. Mathematics gives a final shape to the rules of physics. It presents them in a workable form. Mathematical calculations occur at every step in physics.

The units of measurement are employed to substances in physics as frequently as in mathematics.

- The Chare's law of expansion of gases is based upon mathematical calculations. Graduation of the stem of thermometer and then the conversion of scales is also a mathematical work.

In mathematical physics, some basic axioms about mass, momentum, energy, force, temperature, heat etc. are abstracted, from observations and physical experiments and then the techniques of abstraction, generalization and logical deduction are used.

It focuses on vector spaces, matrix algebra, differential equations, integral equations, integral transforms, infinite series, and complex variables. Its approach can be adapted to applications in electromagnetism, classical mechanics, and quantum mechanics.

It includes celestial mechanics — the study of the motion of celestial objects. The role of Space Dynamics is very important in mechanics. Here we have to consider the trajectories which are time-optimal i.e. which take the least time in going from one point to another and in which the object starts and reaches the destination with zero velocity. Similarly we may have to consider energy- optimal trajectories. We have also to consider the internal and external ballistic of rocket and the path of inter continental ballistic missiles.

Fluid Dynamics :

Understanding the conditions that result in avalanches, and developing ways to predict when they might occur, uses an area of mathematics called fluid mechanics. Many mathematicians and physicists applied the basic laws of Newton to obtain mathematical models for solid and fluid mechanics. This is one of the most widely applied areas of mathematics, and is also used in understanding volcanic eruptions, flight, ocean currents.

- Civil and mechanical engineers still base their models on this work, and numerical analysis is one of their basic tools. In the 19th century, phenomena involving heat, electricity, and magnetism were successfully modeled; and in the 20th century, relativistic mechanics, quantum mechanics, and other theoretical constructs were created to extend and improve the applicability of earlier ideas.
- One of the most widespread numerical analysis techniques for working with such models involves approximating a complex, continuous surface, structure, or process by a finite number of simple elements, known as the finite element method (FEM).

- **Computational Fluid Dynamics :**
- Computational Fluid Dynamics is a discipline wherein we use computers to solve the Navier – Stokes equations for specified initial and boundary condition for subsonic, transonic and hypersonic flows. Many of our research workers use computers, but usually these are used at the final stage when drastic simplifications have already been made, partial differential equation have been reduced to ordinary differential equations and those equations have even been solved.

Physical Oceanography :

Important fluid dynamics problem arise in physical oceanography. Problems of waves, tides, cyclones flows in bays and estuaries, the effect of efflux of pollutants from nuclear and other plants in sea water, particularly on fish population in the ocean are important for study. From defense point of view, the problem of under-water explosions, the flight of torpedoes in water, the sailing of ships and submarines are also important.

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II Semester
PEDAGOGY OF SCHOOL SUBJECT
Mathematics (PSS1A/2A)

Topic : Mathematics as a Interpreter of physical phenomena
and
Relationship of Mathematics with Other disciplines

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Mathematics is the Interpreter of physical phenomena

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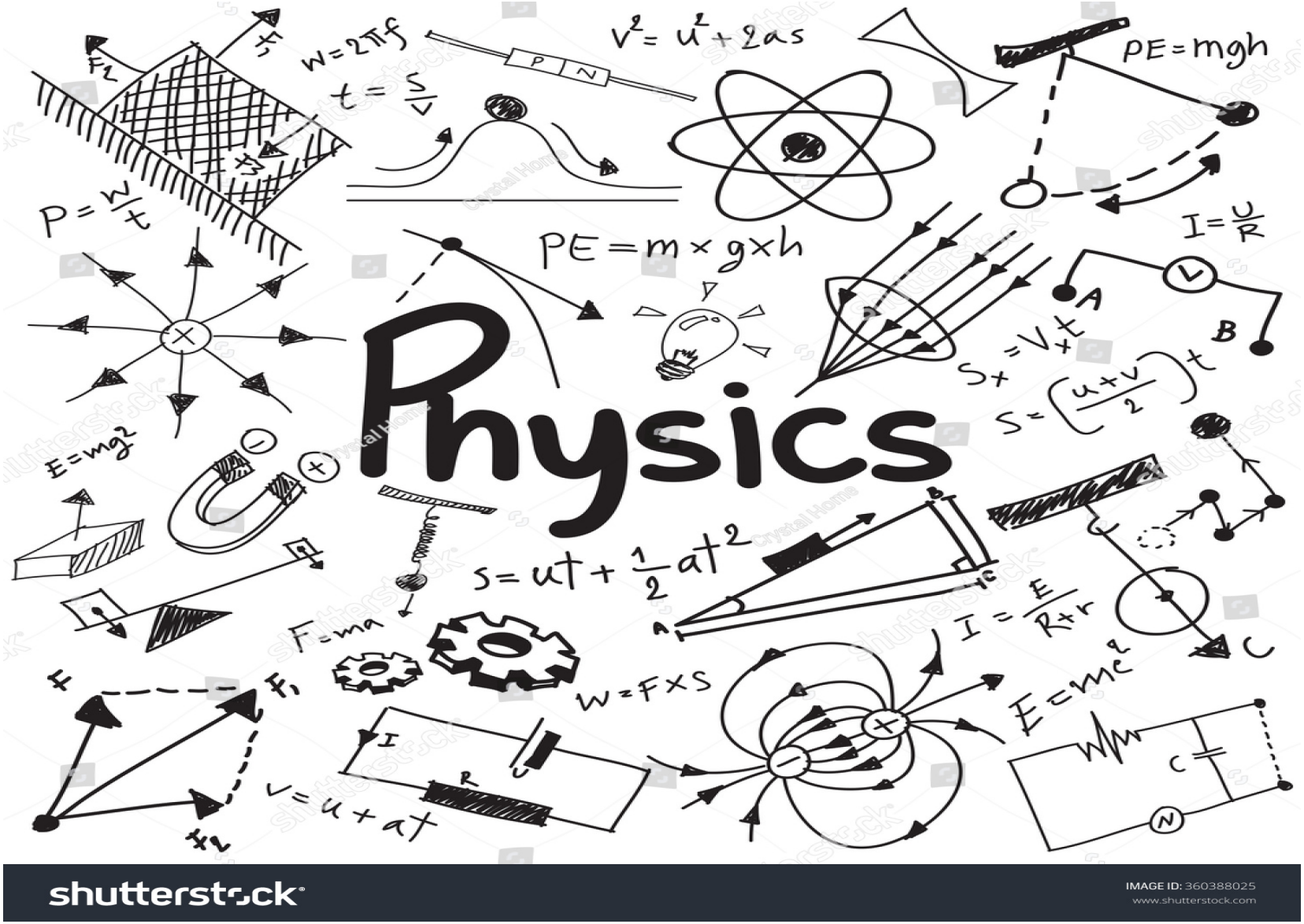
Physics Formulas - Energy

Word Equation	Symbol Equation
Elastic Energy(J) = ½ x spring constant(N/m) x extension^2 (m^2)	$E_e = ½ ke^2$
Kinetic Energy(J) = ½ x mass(kg) x velocity^2(m/s) ^{2}	$KE = ½ mv^2$
Potential Energy(J) = mass(kg) x gravity (N/kg) x height (m)	$PE = mgh$
Change in Thermal Energy(J) = mass(kg) x specific heat capacity(J/kg°C) x change in temperature(°C)	$\Delta E = mc\Delta\theta$
Law of Conservation of Energy Loss of energy = Gain of energy	$mgh = ½ mv^2$
Power (W) = Energy Transferred (J) ÷ Time (s)	$P = \frac{\Delta E}{t}$


Physics
$w = 2\pi f$
$t = \frac{s}{v}$
$v^2 = u^2 + 2as$
$PE = mgh$
$P = \frac{w}{t}$
$PE = m \times g \times h$
$I = \frac{U}{R}$
$s = ut + \frac{1}{2}at^2$
$F = ma$
$W = FXS$
$v = u + at$
$E = mc^2$
$I = \frac{E}{R+r}$
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Energy

Kinetic Energy

$$E_K = \frac{1}{2}mv^2$$

E_K = Kinetic Energy	(J)
m = mass	(kg)
v = velocity	(ms^{-1})

Gravitational Potential Energy

$$E_P = mgh$$

E_P = Potential Energy	(J)
m = mass	(kg)
g = gravitational acceleration	(ms^{-2})
h = height	(m)

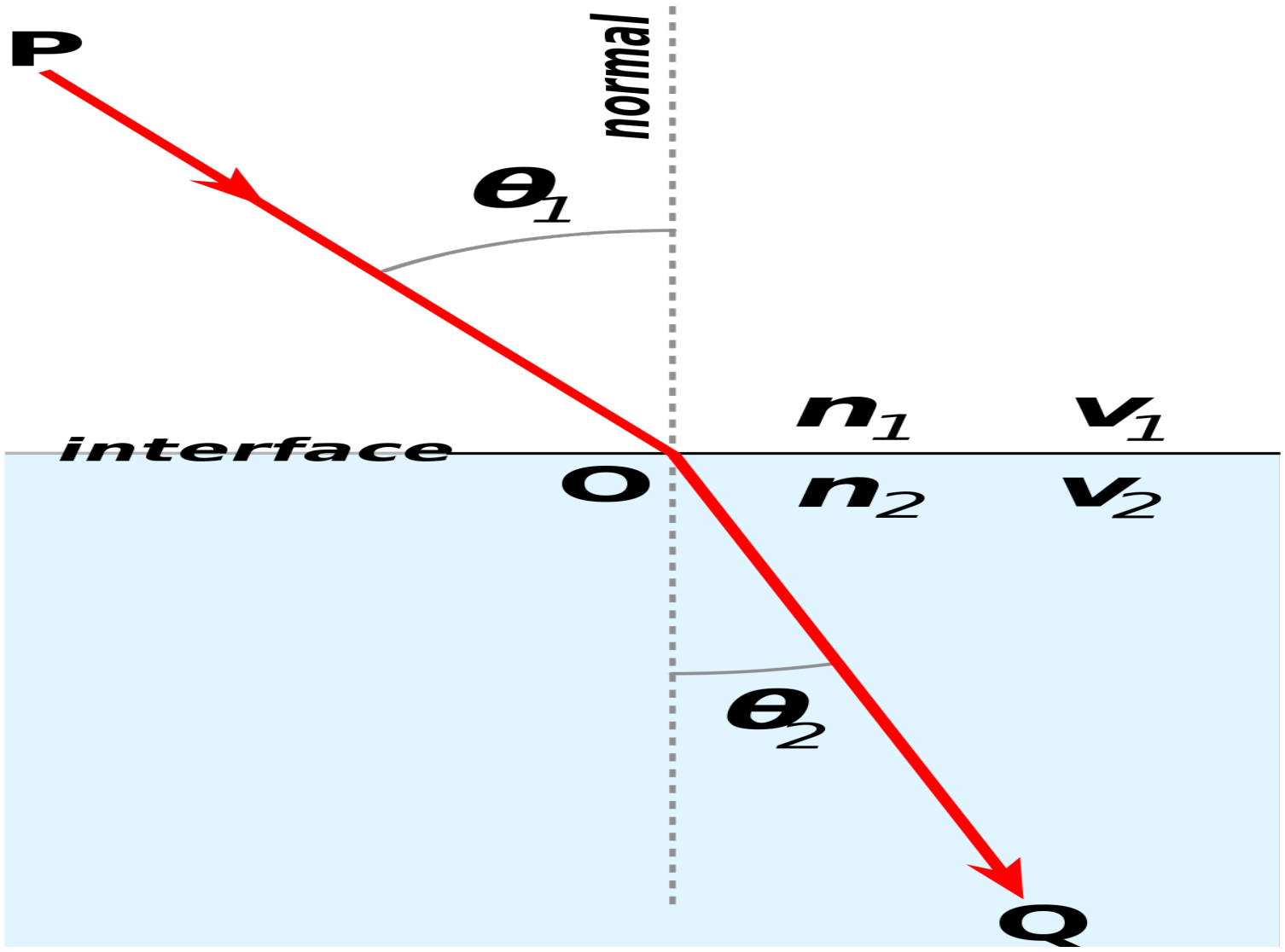
Elastic Potential Energy

$$E_P = \frac{1}{2}kx^2$$

E_P = Potential Energy	(J)
k = spring constant	($N\,m^{-1}$)
x = extension of spring	(m)

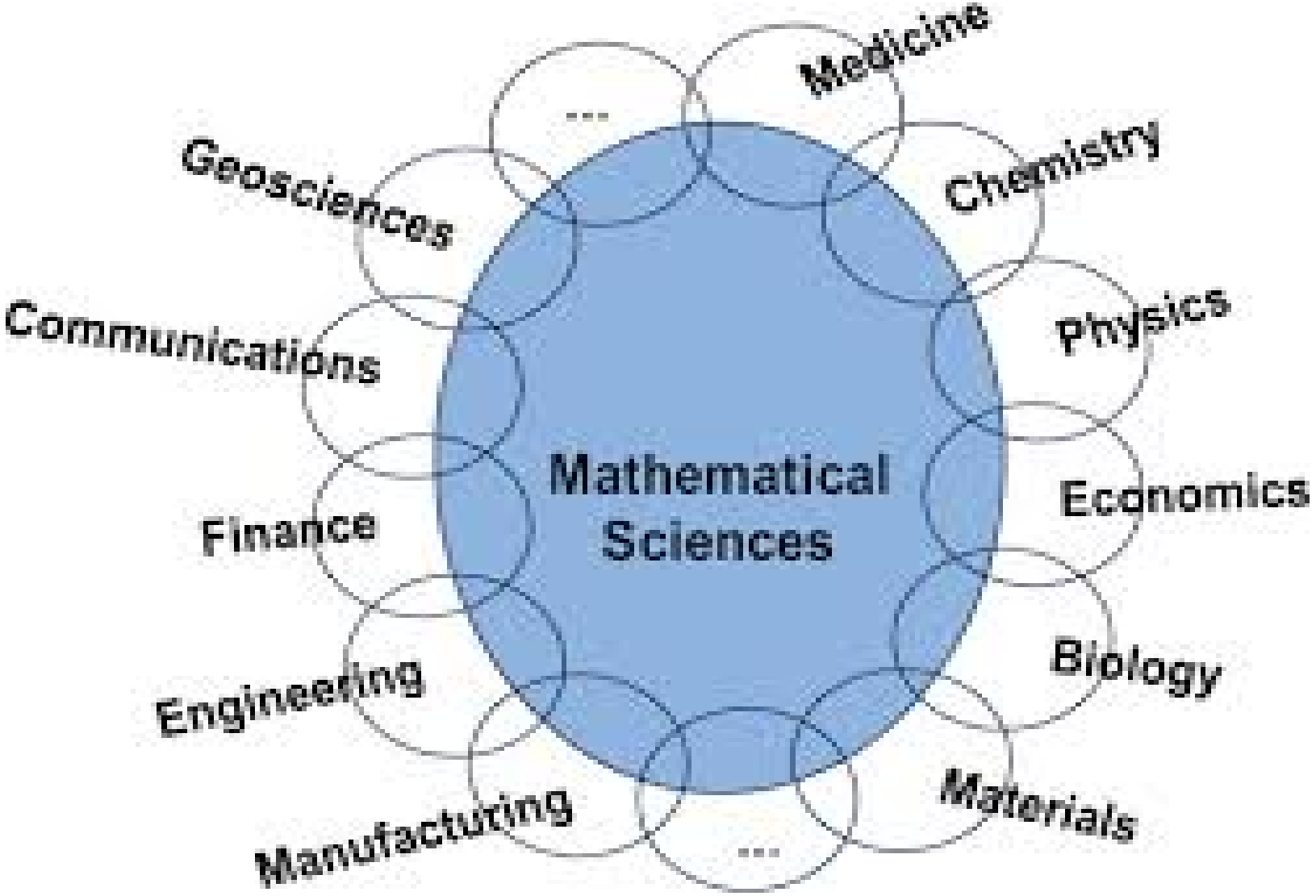
$$E_P = \frac{1}{2}Fx$$

F = Force	(N)


P
normal
θ_1
n_1
v_1
interface
O
n_2
v_2
θ_2
Q

Definition of correlation :

Correlation is the relationship between two or more variables. If the variables are related in such a way that change in one creates a corresponding change in the other then the variable are said to be correlated.


Mathematical Sciences
...
Medicine
Chemistry
Physics
Economics
Biology
Materials
...
Manufacturing
Engineering
Finance
Communications
Geosciences

Correlation of mathematics with life activities

- Mathematics is one subject which has extensive application in our day to day life.
- Mathematics is an indispensable tool of precision in measure involving quantity and time.
- A fundamental knowledge of basic mathematics concept is valuable even for a uneducated man. In his day to day life he calculates his wages, plans his expenses and estimates his balances he is making use of a lot of simple mathematics.

A knowledge of elementary mathematical concepts such as interest rate, banking, percentage, discount, ratio and proportion, variation is very essential to lead a fruitful life in the society.

- While teaching mathematics, the teacher of mathematics should site examples from mathematics to stress upon the practical applications of mathematics.

Introduction :-

Correlation of different branches of mathematics

The different branches of mathematics such as:

- Arithmetic
- Algebra
- Geometry
- Trigonometry
- Co-ordinate geometry.

. The Indian education commission has recommended an integrated approach relating the different branches of mathematics.

- The set language and concept of function may be used to integrated arithmetic, algebra, geometry and analysis.
- The concept of mathematical structures will go a long way in relating the different branches of mathematics to one another

Algebra

Expansion of the

identity (a + b)2 ,

(a + b)2 = (a + b)(a + b)

= a2 + 2ab + b2

= a2 + b2 + 2ab

Geometry

(a + b)2 = a2 + b2 + 2ab

(a + b)2 is represent the area of a square of side (a + b) units which can be further divided into 2 squares of sides a and b respectively and two rectangles of sides a , b.

Correlation of topics in the same branch of mathematics.

- If we take any branch of mathematics the topic in the same branch of mathematics should be correlated to each other.

eg: In algebra, the topic polynomials is related to equation.

In geometry,

the knowledge of area of triangles lead to the derivation of the formula for the area of a quadrilateral, rectangle, square, parallelogram, rhombus, trapezium, regular hexagon and so on.

Algebra

Expansion of the

identity (a + b)2 ,

(a + b)2 = (a + b)(a + b)

= a2 + 2ab + b2

= a2 + b2 + 2ab

Geometry

(a + b)2 = a2 + b2 + 2ab

(a + b)2 is represent the area of a square of side (a + b) units which can be further divided into 2 squares of sides a and b respectively and two rectangles of sides a , b.

• Arithmetic

The same identity can be used to compute 1012 or 10032 and so on

$(1012) = (100+1)\ 2$

$= 1002 + (2 \times 100 \times 1) + 12$

$= 1002 + (2 \times 100) + 1$

Correlation of mathematics with other subjects

- Correlation of Mathematics with Physical science.
- Correlation of Mathematics with Biology.
- Correlation of Mathematics with Engineering.
- Correlation of Mathematics with Social science
- Correlation of Mathematics with Language and Literature.
- Correlation of Mathematics with Art and Architecture.

Correlation of mathematics with physical science

The correlation of mathematics with sciences is well brought out in the following quotations:

"Mathematics is the gateway and key to all sciences" –

-Bacon

"Mathematics is the indispensable instrument of all physical researches"

- Kant

Mathematics gives a workable symbolism for brief and precise expression of ideas to all ,sciences.

All laws and principles in physics are expressed as equations and formulae using mathematical language and symbols.

A few examples are given below

Laws of motion Newton's second law

$V = U + at$ $F = ma$

$V2 = U2 + 2as$

$S = Ut + 1/2\ at2$

Density quantified Boyle's law

$D = m/v$ $PV = RT$

- A teacher of mathematics while teaching equations and variations can make use of, examples from physics such an approach will make mathematics learning more significant.

- Mathematics is an indispensable tool for a better understanding of chemistry.

In the words of J W MELLOR :

“ It is almost impossible to follow the later development of physical or general chemistry without a working knowledge of higher mathematics.”

- Mathematics gives form shape and definiteness to the properties of matter.
- All chemical combinations are governed by certain mathematical law.

Thus mathematics helps to make physical sciences more interesting and practical and the opportunities for correlation are endless.

Correlation of mathematics with biology

- John Perry has correctly estimated the values of mathematics in the study of Natural Sciences by saying:

"In these days all men ought to study natural sciences, such a study is practically impossible without the knowledge of higher mathematical methods.

Correlation of mathematics with Engineering

- Most engineering students interact with mathematics in a similar way.
- It forms the basis for all engineering courses.
- Mathematics used in engineering is in the areas of differential equations, Integration, probability, algebraic geometry …

Correlation of mathematics with social science.

- History n geography are also correlated to mathematics.
- The history of mathematicians and their contributions provide useful background for the teaching of mathematics and history.
- Mathematics helps in calculating the dates and days of various historical events and in predicting the future based on the past events.

- Geography also makes extensive use of mathematics.
- Mathematics helps in drawing the maps to the scale and locating places and estimating the distance between different places.
- Economics and psychology are mathematically oriented.
- In economics, mathematical language and methods are frequently used to interpret social phenomena, generalise laws governing economic policy and predict economic growth.

Correlation of mathematics with language and literature

- Language is the vehicle for communication and mathematics cannot be learned without the use of language.
- Certain mathematical concepts specially abstract concepts can be learned only in the form of verbal statement known as Definitions.
- Mathematics helps the students to learn the language with clarity and exactness.

Correlation of mathematics with Art and Architecture

- Mathematics helps in appreciating the beauty in art and architeccture.

Shaw states,

"Mathematics is engaged in fact, in the profound study of art and the expression of beauty."

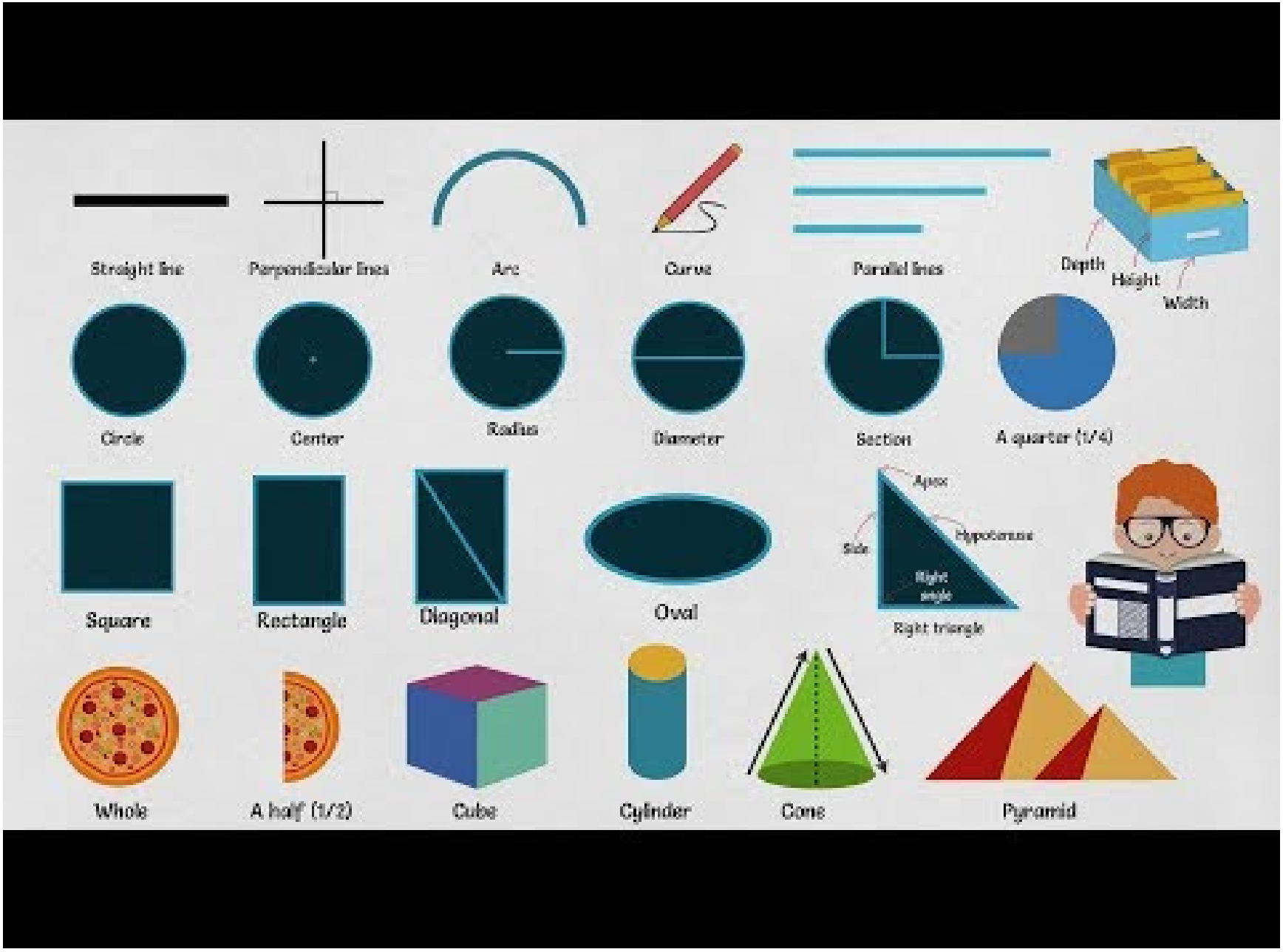
Therefore, itself is a piece of art, a study of harmony and of symmetry.

- The artists, in turn, weave their knowledge of form, symmetry and proportion into their creations to make it beautiful.

- There is beauty , symmetry, pattern and rhythm in mathematics and one could derive happiness and satisfaction from mathematics like any other piece of art.

Conclusion

Modern civilization is very much influenced by the development of mathematics. So here we can conclude that Mathematics provides perfectness to all sciences. In addition to science, mathematics makes direct relationship with language and literature. Any science oriented research is unable to establish with out mathematics. Mathematics provides direct relationship not only with the subjects of Pure sciences such as Physics, chemistry, Biology etc. but also provides direct relationship with the subjects of social sciences such as History , Geography , Economics etc.


Straight line
Perpendicular lines
Arc
Curve
Parallel lines
Depth
Height
Width
Circle
Center
Radius
Diameter
Section
A quarter (1/4)
Square
Rectangle
Diagonal
Oval
Apex
Side
Hypotenuse
Right angle
Right triangle
Whole
A half (1/2)
Cube
Cylinder
Cone
Pyramid

Mathematics Symbols

+	plus	=	is equal to	⇔	is equivalent to
−	minus	≠	is not equal to	⇒	implies
×	multiplied by	~	is similar to	θ	theta
÷	divided by	≅	is congruent to	∅	empty set
±	plus or minus	∞	infinity	Δ	triangle or delta
>	is greater than	≥	is greater than or equals	∀	for all
<	is less than	≤	is less than or equals	π	pi; 3.14159

∫	integral	!	factorial	⊥	perpendicular
∩	intersection of two sets	∴	therefore	∃	exists
∪	union of two sets	√	Square root of	%	percent

$\overleftrightarrow{AB}$	line AB	∟	right angle	{ }	braces (grouping)
$\overline{AB}$	segment AB	∠	angle	[ ]	brackets
$\overrightarrow{AB}$	ray AB	Σ	sum of	( )	parentheses (grouping)

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Some of the important and familiar symbols used in Mathematics are given below :

- l l - Parallel lines
- > - greater than
- < - less than
- ≡ - congruency
- √ - Square root
- ∟ - Angle
- Σ - Summation
- + - addition
- - - subtraction
- x - Multiplication
- / - Division
- % - percentage and so on.

It is highly impossible to prepare a comprehensive list of at the mathematical symbols. Anyone, who wants to read and communicate effectively in mathematical language, has to be well versed in the mathematical symbols and their definite uses. The misunderstanding of symbols, lead students to lose interest in the subject which appears to them, dull and boring. So, teachers should train the pupil in the correct use of mathematical language and symbols. They should learn to appreciate the beauty, precision and exactness of mathematical language and symbols and should understand that, "Wherever there is a structure, relationship, regularity, systematic variation, there is Mathematics".

Mathematics as a science of measurement and quantification(Numbers):

- Measurement is the assignment of a numerical value to an attribute of an object, or the assignment of a number to a characteristic of a situation.
- Mathematics is a science of measurement because measurement is an outcome of a sequence of operations carried out under a set of specified, realizable and experimental conditions.
- Measurement is fundamental to the teaching and learning of mathematics because it provides a natural way to the development of number concepts and also to the application of mathematics over a very wide field.

- Mathematics in a realistic setting provides a logical way in teaching mathematics, in real life context in which number concepts are applied and used.
- Measurement as a mathematical concept may be more easily accessible to students because it exists all around them in their everyday lives.
- Students can learn to perform accurately a number of measuring procedures and use the results to make judgments about the magnitude of quantities.
- One of the most obvious features of mathematics is its fixation with putting numbers to things, by quantification using mathematical formulae.

In mathematics, magnitudes and multitudes are two kinds of quantity to be measured and they are commensurable with each other. Setting the units of measurement,

Mathematics also covers such fundamental quantities as space (length, breadth and depth) and time, mass and force etc., The topics such as numbers, number systems, with their kinds and relations, fall into the number theory.

Geometry studies the issues of spatial magnitudes: straight line (their length, and relationships as parallels, perpendiculars, angles) and curved lines (kinds and number and degree) with their relationships (tangents, secants, and asymptotes). Also it encompasses surface and solids, their transformation, measurements and relationships.

Mathematics is the Interpreter of physical phenomena

In Physics, every rule and principle takes the mathematical form ultimately. Mathematics gives a final shape to the rules of physics. It presents them in a workable form. Mathematical calculations occur at every step in physics.

The units of measurement are employed to substances in physics as frequently as in mathematics.

- The Chare's law of expansion of gases is based upon mathematical calculations. Graduation of the stem of thermometer and then the conversion of scales is also a mathematical work.

In mathematical physics, some basic axioms about mass, momentum, energy, force, temperature, heat etc. are abstracted, from observations and physical experiments and then the techniques of abstraction, generalization and logical deduction are used.

It focuses on vector spaces, matrix algebra, differential equations, integral equations, integral transforms, infinite series, and complex variables. Its approach can be adapted to applications in electromagnetism, classical mechanics, and quantum mechanics.

It includes celestial mechanics — the study of the motion of celestial objects. The role of Space Dynamics is very important in mechanics. Here we have to consider the trajectories which are time-optimal i.e. which take the least time in going from one point to another and in which the object starts and reaches the destination with zero velocity. Similarly we may have to consider energy- optimal trajectories. We have also to consider the internal and external ballistic of rocket and the path of inter continental ballistic missiles.

Fluid Dynamics :

Understanding the conditions that result in avalanches, and developing ways to predict when they might occur, uses an area of mathematics called fluid mechanics. Many mathematicians and physicists applied the basic laws of Newton to obtain mathematical models for solid and fluid mechanics. This is one of the most widely applied areas of mathematics, and is also used in understanding volcanic eruptions, flight, ocean currents.

- Civil and mechanical engineers still base their models on this work, and numerical analysis is one of their basic tools. In the 19th century, phenomena involving heat, electricity, and magnetism were successfully modeled; and in the 20th century, relativistic mechanics, quantum mechanics, and other theoretical constructs were created to extend and improve the applicability of earlier ideas.
- One of the most widespread numerical analysis techniques for working with such models involves approximating a complex, continuous surface, structure, or process by a finite number of simple elements, known as the finite element method (FEM).

- **Computational Fluid Dynamics :**
- Computational Fluid Dynamics is a discipline wherein we use computers to solve the Navier – Stokes equations for specified initial and boundary condition for subsonic, transonic and hypersonic flows. Many of our research workers use computers, but usually these are used at the final stage when drastic simplifications have already been made, partial differential equation have been reduced to ordinary differential equations and those equations have even been solved.

Physical Oceanography :

Important fluid dynamics problem arise in physical oceanography. Problems of waves, tides, cyclones flows in bays and estuaries, the effect of efflux of pollutants from nuclear and other plants in sea water, particularly on fish population in the ocean are important for study. From defense point of view, the problem of under-water explosions, the flight of torpedoes in water, the sailing of ships and submarines are also important.


Thank you


Thank you