

*Draft*

# **Curriculum for Mathematics, Grades IX-X (Revised in 2017)**

Reviewed by the Committee for review of Curriculum & Textbooks for the subject of  
Mathematics Grade (IX-X) at secondary level  
vide Notification No:SO(G-I)SED/HCW/103/ 2017 Dated: 28<sup>th</sup> April 2017

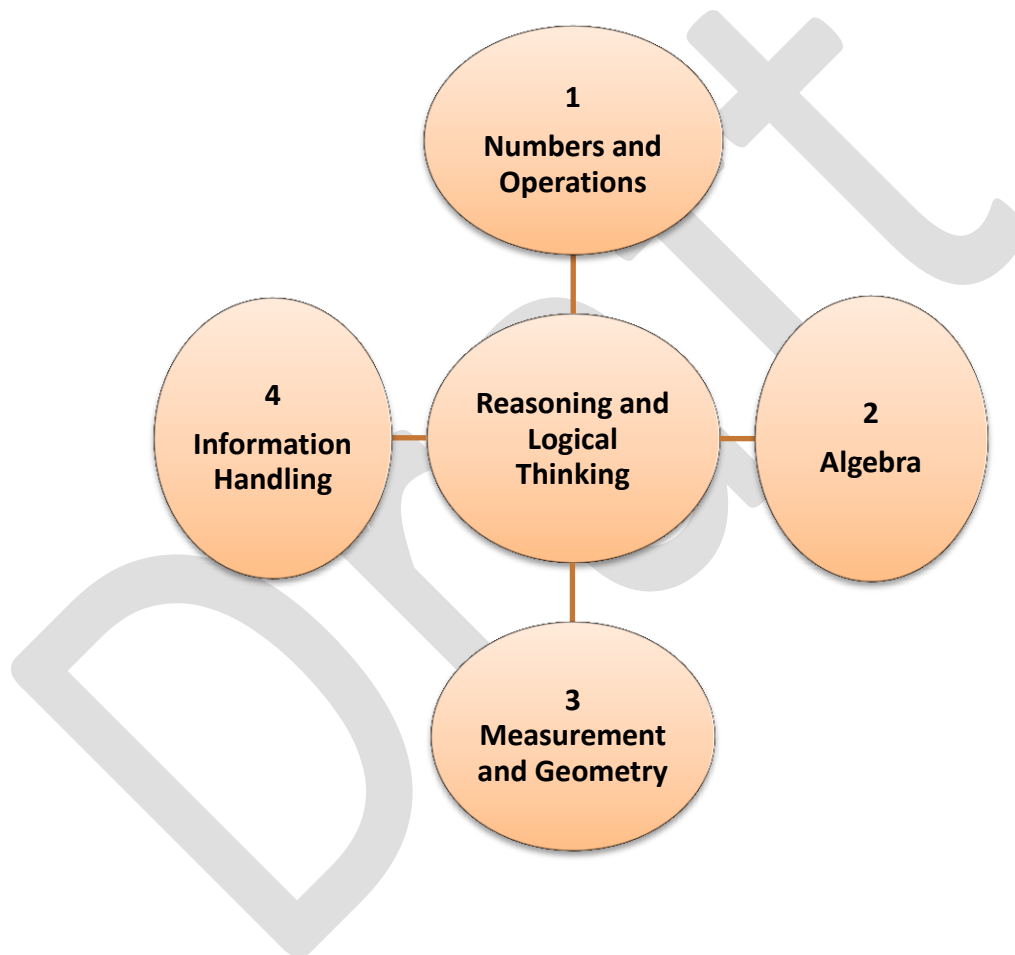


**Bureau of Curriculum and Extension Wing Sindh, Jamshoro  
School Education Department  
Government of Sindh**

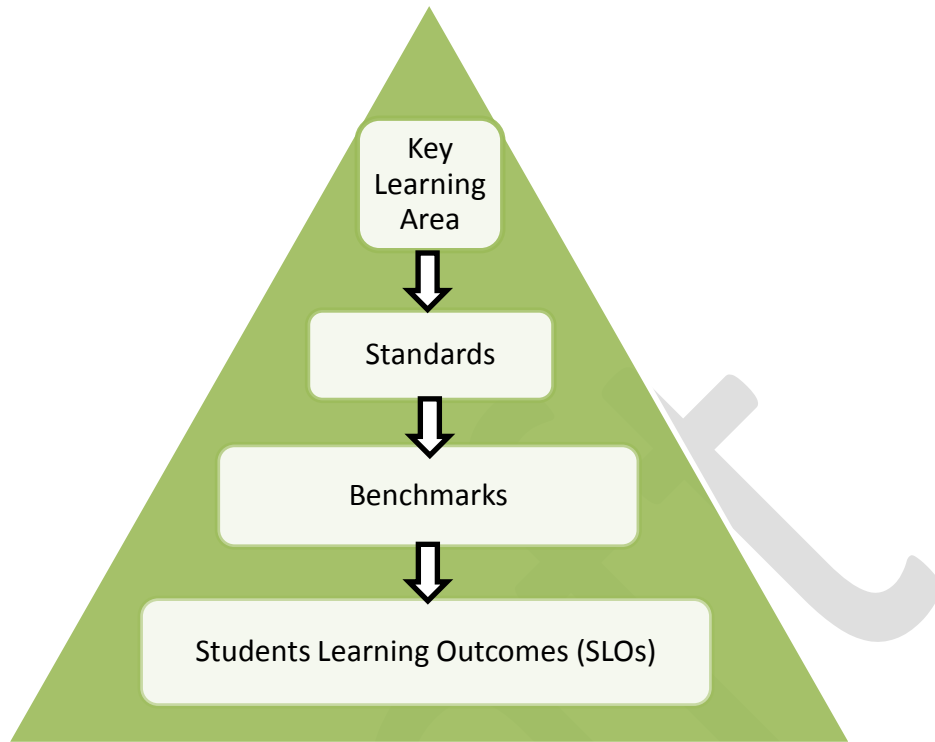
## INTRODUCTION:

The Curriculum for Mathematics Grades IX-X (revised in 2017) is comprised of four Key Learning Areas (competency), which are Numbers and Operations, Algebra, Measurement & Geometry and Information.

Further, ‘Reasoning and Logical Thinking’ is an integral part of every Key Learning Areas (competency) and it is embedded in each key learning area.



Each ‘Key Learning Areas (competency)’ is further classified into standards, benchmarks, Students Learning Outcomes (SLO). The figure below indicates their linkage, given as under:



The benchmarks, thereafter, serve as a guide indicating how competencies at a particular developmental level are to be attained in order to meet the standards. They provide indicators of expectations from students at completion of each of five developmental stages: grades I to II, III to V, VI to VIII, IX to X and XI to XII.

### **THE THEMES OF CURRICULUM FOR MATHEMATICS:**

1. The curriculum is designed to help students build the solid conceptual foundation in Mathematics that will enable them to apply their knowledge skillfully and further their learning successfully.
2. The curriculum emphasizes on the geometrical concepts that enable the students to think logically; reason systematically and conjecture astutely.
3. The curriculum stresses graphics that enable the students to visualize and interpret mathematical expressions correctly rather to manipulate them ‘blindly’.
4. The curriculum recognizes the benefits that current technologies can bring to the learning and doing mathematics. It, therefore, integrates the use of appropriate technologies to enhance learning in an ever increasingly information–rich world.
5. The curriculum serves as a catalyst for the learning of other disciplines

## CURRICULUM FOR MATHEMATICS, GRADE IX

Content of scope	Learning outcomes/ skills
<b>All students will be able to</b>	

### UNIT-1: REAL AND COMPLEX NUMBERS

1.1 Real numbers	<ul style="list-style-type: none"> <li>i) Recall the set of real numbers as the union set of rational and irrational numbers.</li> <li>ii) Represent real numbers on the number line.</li> <li>iii) Demonstrate a number with terminating and non-terminating recurring decimal on the number line.</li> <li>iv) Distinguish the decimal representation of rational and irrational numbers.</li> </ul>
1.2 Properties of Real Numbers	Know the properties of real numbers.
1.3 Radicals and Radicands	<ul style="list-style-type: none"> <li>i) Identify radicals and radicands.</li> <li>ii) Differentiate between radical and exponential forms of an expression.</li> <li>iii) Transform an expression given in radical form to an exponent form and vice versa.</li> </ul>
1.4 Laws of Exponents/Indices	<ul style="list-style-type: none"> <li>i) Recall base, exponent and value.</li> <li>ii) Apply the laws of exponents to simplify expressions with real exponents.</li> </ul>
1.5 Complex Numbers	<ul style="list-style-type: none"> <li>i) Elucidate, then define a complex number <math>z</math> represented by an expression of the form <math>(a,b)</math> or <math>z = a + ib</math>, where <math>a</math> and <math>b</math> are real numbers and <math>i = \sqrt{-1}</math>.</li> <li>ii) Recognize <math>a</math> as real part and <math>b</math> as imaginary part of <math>z = a + ib</math> or <math>z = (a,b)</math>.</li> <li>iii) Define conjugate of a complex number.</li> <li>iv) Know the condition of equality of complex numbers.</li> </ul>
1.6 Basic Operations on Complex Numbers	Carry-out basic operations (i.e., addition, subtraction, multiplication and division) on complex numbers.

## UNIT-2: LOGARITHMS

2.1 Scientific Notation	Express a number in standard form of scientific notation and vice versa.
2.2 Logarithms	<p>i) Define logarithm of a real number to a base <math>a</math> as a power to which <math>a</math> must be raised to give the number (i.e., <math>a^x = y \Leftrightarrow \log_a y = x</math>, <math>a &gt; 0</math>, <math>y &gt; 0</math> and <math>a \neq 1</math>).</p> <p>ii) Define a common logarithm, characteristic and mantissa of log of a number.</p> <p>iii) Use tables to find the log of a number.</p> <p>iv) Give concept of antilog and use tables to find the antilog of a number.</p> <p>v) Use of calculator to find the log &amp; antilog of a number.</p>
2.3 Common and Natural Logarithm	<p>Differentiate between common and natural logarithms.</p> <p>Write, <math>\log_{10} y = \log y</math> or <math>lg y</math> and <math>\log_e y</math> as <math>\ln y</math>,</p> <p><math>lg y = x \Leftrightarrow y = 10^x</math>,</p> <p><math>\ln y = x \Leftrightarrow y = e^x</math></p>
2.4 Laws of logarithms	<p>Prove the following laws of logarithms.</p> <ul style="list-style-type: none"> <li>• <math>\log_a (mn) = \log_a m + \log_a n</math>,</li> <li>• <math>\log_a \left(\frac{m}{n}\right)</math></li> <li>• <math>\log_a m^n = n \log_a m</math>,</li> <li>• <math>\log_a m \log_a n = \log_a n</math>.</li> </ul>
2.5 Application of Logarithms	Apply laws of logarithms to convert lengthy processes of multiplication, division and exponentiation into easier processes of addition and subtraction etc.

## UNIT-3: ALGEBRAIC EXPRESSIONS AND FORMULAS

3.1 Algebraic Expressions	<p>i) Know that a rational expression behaves like a rational number.</p> <p>ii) Define a rational expression as a quotient <math>\frac{p(x)}{q(x)}</math> of two polynomials <math>p(x)</math> and <math>q(x)</math>, where <math>q(x)</math>, is not the zero polynomial.</p>
---------------------------	---

	<p>iii) Examine whether a given algebraic expression is a</p> <ul style="list-style-type: none"> <li>• Polynomial or not,</li> <li>• Rational expression or not.</li> </ul> <p>iv) Define <math>(p(x)/q(x))</math> as a rational expression in its lowest term, if <math>p(x)</math> and <math>q(x)</math> are polynomials with integral coefficients and having no common factor.</p> <p>v) Examine whether a given rational algebraic expression is in its lowest form or not.</p> <p>vi) Reduce a given rational expression to its lowest form.</p> <p>vii) Find the sum, difference and the product of rational expressions.</p> <p>viii) Divide a rational expression by another rational expression and express the result in its lowest form.</p> <p>ix) Find the values of the algebraic expressions at some particular real number.</p>
<p>3.2 Algebraic Formulas</p>	<p>i) Know the formulas</p> $(a + b)^2 + (a - b)^2 = 2(a^2 + b^2),$ $(a + b)^2 - (a - b)^2 = 4ab.$ <ul style="list-style-type: none"> <li>• Find the values of <math>a^2 + b^2</math> and of <math>ab</math> when the values of <math>a + b</math> and <math>a - b</math> are known.</li> </ul> <p>ii) Know the formula</p> $(a + b + c)^2 = a^2 + b^2 + c^2 + 2ab + 2bc + 2ca$ <ul style="list-style-type: none"> <li>• Find the values of <math>a^2 + b^2 + c^2</math> when the values of <math>a + b + c</math> and <math>ab + bc + ca</math> are given.</li> <li>• Find the value of <math>a + b + c</math> when the values of <math>a^2 + b^2 + c^2</math> and <math>ab + bc + ca</math> are given.</li> <li>• Find the value of <math>ab + bc + ca</math> when the values of <math>a^2 + b^2 + c^2</math> and <math>a + b + c</math> are given.</li> </ul> <p>iii) Know the formulas</p> $(a + b)^3 = a^3 + 3ab(a + b) + b^3,$ $(a - b)^3 = a^3 - 3ab(a - b) - b^3.$ <ul style="list-style-type: none"> <li>• Find the values of <math>a^3 \pm b^3</math> when the values of <math>a \pm b</math> and <math>ab</math> are given.</li> <li>• Find the values of <math>x^3 \pm \frac{1}{x^3}</math>, when the value of <math>x \pm \frac{1}{x}</math> is given.</li> </ul>

	<p>iv) Know the formula</p> $a^3 \pm b^3 = (a \pm b)(a^2 \pm ab + b^2)$ <ul style="list-style-type: none"> <li>• Find the product of <math>x + \frac{1}{x}</math> and <math>x^2 + \frac{1}{x^2} - 1</math></li> <li>• Find the product of <math>x - \frac{1}{x}</math> and <math>x + \frac{1}{x^2} + 1</math></li> <li>• Find the continued product of <math>(x + y)(x - y)(x^2 + xy + y^2)(x^2 - xy + y^2)</math>.</li> </ul>
3.3 Surds and their applications	<p>i) Recognize the surds and their applications.</p> <p>ii) Explain the surds of the second order. Use basic operations on surds of second order to rationalize the denominators and to evaluate them.</p>
3.4 Rationalization	<p>Explain rationalization (with precise meaning) of real numbers of the types <math>\frac{1}{a + b\sqrt{x}}</math>, <math>\frac{1}{\sqrt{x} + \sqrt{y}}</math> and their combinations, where <math>x</math> and <math>y</math> are natural numbers and <math>a</math> and <math>b</math> are integers.</p>

## UNIT-4: FACTORIZATION

4.1 Factorization	<p>i) Recall factorization of expressions of the following types.</p> <ul style="list-style-type: none"> <li>• <math>ka + kb + kc</math>, (Common factors in all the terms)</li> <li>• <math>ac + ad + bc + bd</math>, (Common factors in pairs of terms)</li> <li>• <math>a^2 \pm 2ab + b^2</math>, (Perfect squares)</li> <li>• <math>a^2 - b^2</math>, (Difference of two squares)</li> <li>• <math>a^2 \pm 2ab + b^2 - c^2</math>.</li> <li>• <math>(\sqrt{a})^2 - (\sqrt{b})^2</math></li> </ul> <p>ii) Factorize the expressions of the following types:</p> <p>Type I: <math>a^4 + a^2b^2 + b^4</math> and <math>a^4 + 4b^4</math>,</p> <p>Type II: <math>x^2 + px + q</math>,</p> <p>Type III: <math>ax^2 + bx + c</math>,</p> <p>Type IV: <math>(ax^2 + bx + c)(ax^2 + bx + d) + k</math>,  <math>(x + a)(x + b)(x + c)(x + d) + k</math>,  <math>(x + a)(x + b)(x + c)(x + d) + kx^2</math>,</p> <p>Type V: <math>a^3 + 3a^2b + 3ab^2 + b^3</math>,  <math>a^3 - 3a^2b + 3ab^2 - b^3</math>,</p> <p>Type VI: <math>a^3 \pm b^3</math>.</p>
-------------------	--

4.2 Remainder and Factor Theorems	i) State and prove remainder theorem and explain through examples. ii) Find remainder (without dividing) when a polynomial is divided by a linear polynomial. iii) Define zero of a polynomial. iv) State and prove factor theorem.
4.3 Synthetic Division	i) Describe the method of synthetic division. ii) Use synthetic division to <ul style="list-style-type: none"> <li>• Find quotient and remainder when a given polynomial is divided by a linear polynomial,</li> <li>• Find the value(s) of unknown(s) if the zeros of the polynomial are given.</li> <li>• Find the value(s) of unknown(s) if the factors of the polynomial are given,</li> </ul>
4.4 Factorization of Cubic Polynomial	Use factor theorem to factorize a cubic polynomial.

### UNIT-5: ALGEBRAIC MANIPULATION

5.1 Highest Common Factor (HCF)/Greatest Common Divisor (GCD) and Least Common Multiple (LCM)	i) Find Highest Common Factor (HCF) and Least Common Multiple (LCM) of algebraic expressions by factorization method. ii) Use division method to determine highest common factor and least common multiple. iii) Know the relationship between HCF and LCM. iv) Solve real life problems related to HCF and LCM.
5.2 Basic Operations on Algebraic Fractions	Use highest common factor and least common multiple to reduce fractional expressions involving addition, subtraction, multiplication and division
5.3 Square Root of an Algebraic Expression	Find square root of an algebraic expression by factorization and division methods

## UNIT-6: LINEAR EQUATIONS AND INEQUALITIES

6.1 Linear Equations	<ol style="list-style-type: none"><li>i) Recall linear equations in one variable.</li><li>ii) Solve linear equations with rational coefficients.</li><li>iii) Reduce equations, involving radicals, to simple linear form and find their solutions.</li></ol>
6.2 Equations involving absolute values	<ol style="list-style-type: none"><li>i) Define absolute value.</li><li>ii) Solve the equations, involving absolute values in one variable.</li></ol>
6.3 Linear Inequalities	<ol style="list-style-type: none"><li>i) Define inequalities (<math>&gt;</math>, <math>&lt;</math>) and (<math>\geq</math>, <math>\leq</math>).</li><li>ii) Recognize properties of inequalities (i.e., trichotomy, transitive, additive and multiplicative).</li></ol>
6.4 Solving Linear Inequalities	Solve linear inequalities with rational coefficients.

## UNIT-7: LINEAR GRAPHS AND THEIR APPLICATIONS

7.1 Cartesian Plane and Linear Graphs	<ol style="list-style-type: none"><li>i) Identify pair of real numbers as an ordered pair.</li><li>ii) Recognize an ordered pair through different examples; for instance an ordered pair (2,3) to represent a seat, located in an examination hall, at the intersection of 2<sup>nd</sup> row and 3<sup>rd</sup> column.</li><li>iii) Describe rectangular and Cartesian plane consisting of two number lines intersecting at right angles at a point O.</li><li>iv) Identify origin O and coordinate axes (Horizontal and Vertical axis or x-axis and y-axis respectively) in rectangular plane.</li><li>v) Locate an ordered pair <math>(a,b)</math> as a geometrical point in the rectangular plane and recognize:<ul style="list-style-type: none"><li>• <math>a</math> as the <math>x</math>-coordinate (or abscissa),</li><li>• <math>b</math> as the <math>y</math>- coordinate (or ordinate).</li></ul></li><li>vi) Draw different geometrical shapes (e.g., line segment, triangle and rectangle etc.) by joining a set of given points.</li><li>vii) Construct a table for pairs of values satisfying a linear equation in two variables.</li></ol>
---------------------------------------	--

	<p>viii) Plot the pairs of points to obtain the graph of a given expression.</p> <p>ix) .Choose an appropriate scale to draw a graph.</p> <p>x) Draw the graph of</p> <ul style="list-style-type: none"> <li>• an equation of the form <math>y = c</math>.</li> <li>• an equation of the form <math>x = a</math>.</li> <li>• an equation of the form <math>y = mx</math>.</li> <li>• an equation of the form <math>y = mx + c</math>.</li> </ul> <p>xi) Draw a graph from the given table of (discrete) values.</p> <p>xii) Solve allied real life problems.</p>
7.2 Conversion Graphs	<p>i) Interpret conversion graph as a linear graph relating to two quantities which are in direct proportions.</p> <p>ii) Read a given graph to know one quantity corresponding to another.</p> <p>iii) Read the graph for conversion of the forms:</p> <ul style="list-style-type: none"> <li>• Miles and kilometers,</li> <li>• Acres and hectares,</li> <li>• Degrees Celsius and Fahrenheit,</li> <li>• Pakistani currency and other currencies, etc.</li> </ul>
7.3 Graphic Solution of Equations in two variables	Solve simultaneous linear equations in two variables by graphical method.

## UNIT-8: QUADRATIC EQUATIONS

8.1 Quadratic Equations and their Solutions.	<p>i) Elucidate, then define quadratic equation in its standard form.</p> <p>ii) Solve a quadratic equation in one variable by</p> <ul style="list-style-type: none"> <li>• Factorization,</li> <li>• Completing the squares.</li> </ul>
8.2 Quadratic Formula	<p>i) Use method of completing the squares to drive the quadratic formula.</p> <p>ii) Use quadratic formula to solve quadratic equations.</p>

<p>8.3 Equations Reducible to Quadratic Form</p>	<p>i) Solve equations, reducible to quadratic form, of the type <math>ax^4 + bx^2 + c = 0</math>, Quartic or bi-quadratic equations.</p> <p>ii) Solve the equations of the type <math>a p(x) + \frac{b}{p(x)} = c</math>, where a, b and c are constants.</p> <p>iii) Solve the reciprocal equations of the type <math>a(x^2 + \frac{1}{x^2}) + b(x + \frac{1}{x}) + c = 0</math>, where a, b and c are rational constants</p> <p>iv) Solve the exponential equations in which the variable occurs in exponents.</p> <p>v) Solve the equations of the type <math>(x+a)(x+b)(x+c)(x+d)=k</math>, where <math>a+b = c+d</math> and the constant <math>k \neq 0</math>.</p>
<p>8.4 Radical Equations</p>	<p>Solve the equations of the type:</p> <ul style="list-style-type: none"> <li>• <math>\sqrt{ax + b} = cx + d</math>.</li> <li>• <math>\sqrt{x + a} + \sqrt{x + b} = \sqrt{x + c}</math></li> <li>• <math>\sqrt{x^2 + px + m} + \sqrt{x^2 + px + n} = q</math></li> </ul>

## UNIT-9: CONGRUENT TRIANGLES

<p>9.1 Congruent Triangles</p>	<p>Understand the following theorems along with their corollaries and apply them to solve allied problems.</p> <ol style="list-style-type: none"> <li>a) In any correspondence of two triangles, if one side and any two angles of one triangle are congruent to the corresponding sides and angles of the other, the two triangles are congruent.</li> <li>b) If two angles of a triangle are congruent then the sides opposite to them are also congruent.</li> <li>c) In the correspondence of the two triangles, if three sides of one triangle are congruent to the corresponding three sides of the other, the two triangles are congruent.</li> <li>d) If in the correspondence of two right angled triangles, the hypotenuse and one side of one are</li> </ol>
--------------------------------	---

	congruent to the hypotenuse and the corresponding side of the other, then the triangles are congruent.
--	--

## UNIT-10: PARALLELOGRAMS AND TRIANGLES

10.1 Parallelograms and Triangles	<p>Understand the following theorems along with their corollaries and apply them to solve allied problems.</p> <ol style="list-style-type: none"> <li>a) In a parallelogram: <ul style="list-style-type: none"> <li>• The opposite sides are congruent,</li> <li>• The opposites angles are congruent,</li> <li>• The diagonals bisect each other.</li> </ul> </li> <li>b) If two opposite sides of a quadrilateral are congruent and parallel, it is a parallelogram.</li> <li>c) The line segments joining the midpoints of two sides of a triangle, is parallel to the third side and it is equal to one half of its length.</li> <li>d) The medians of a triangle are concurrent and their point of concurrency is the point of trisection of each median.</li> <li>e) If three or more parallel lines make congruent intercepts on the transversal, they also intercept congruent segments on any other line that cuts them.</li> </ol>
-----------------------------------	--

## UNIT-11: LINE BISECTORS AND ANGLE BISECTORS

11.1 Line Bisectors and Angle Bisectors	<p>Understand the following theorems along with their corollaries and apply them to solve allied problems.</p> <ol style="list-style-type: none"> <li>a) Any point on the right bisector of a line segment is equidistant from its end points.</li> <li>b) Any point equidistant from the points of a line segment is on its right bisector.</li> <li>c) The right bisectors of the sides of a triangle are concurrent.</li> <li>d) Any point on the bisector of an angle is equidistant</li> </ol>
---	---

	<p>from its arms.</p> <p>e) Any point inside an angle, equidistant from its arms, is on its bisector.</p> <p>f) The bisectors of the angles of a triangle are concurrent.</p>
--	---

## UNIT-12: SIDES AND ANGLES OF A TRIANGLE

<p>12.1 Sides and Angles of a Triangle</p>	<p>Understand the following theorems along with their corollaries and apply them to solve allied problems.</p> <p>a) If two sides of a triangle are unequal in length, the longer side has an angle of greater measure opposite to it.</p> <p>b) If two angles of a triangle are unequal in measure, the side opposite to the greater angle is longer than the side opposite to the smaller angle.</p> <p>c) The sum of the lengths of any two sides of a triangle is greater than the length of the third side.</p> <p>d) From a point, out-side a line, the perpendicular is the shortest distance from the point to the line.</p>
--	--

## UNIT-13: PRACTICAL GEOMETRY - TRIANGLES

<p>13.1 Construction of Triangle</p>	<p>i) Construct a triangle having given:</p> <ul style="list-style-type: none"> <li>• Two sides and the included angle,</li> <li>• One side and two of the angles,</li> <li>• Two of its sides and the angle opposite to one of them, (with all the three possibilities)</li> </ul> <p>ii) Draw :</p> <ul style="list-style-type: none"> <li>• Angle bisectors,</li> <li>• Altitudes,</li> <li>• Perpendicular bisectors,</li> <li>• Medians</li> </ul> <p>of a given triangle and verify their given concurrency.</p>
--------------------------------------	--

13.2 Figures with Equal Areas	<ul style="list-style-type: none"> <li>i) Construct a triangle equal in area to a given quadrilateral.</li> <li>ii) Construct a rectangle equal in area to a given triangle.</li> <li>iii) Construct a square equal in area to a given rectangle.</li> <li>iv) Construct a triangle of equivalent area on a base of given length.</li> </ul>
-------------------------------	--

### UNIT-14: THEOREMS RELATED WITH AREA

14.1 Theorems Related with Area	<p>Understand the following theorems along with their corollaries and apply them to solve allied problems.</p> <ul style="list-style-type: none"> <li>a) Parallelograms on the same base and lying between the same parallel lines (or of the same altitude) are equal in area.</li> <li>b) Parallelograms on equal bases and having the same altitude are equal in area.</li> <li>c) The triangles on the same base and of the same altitude are equal in area.</li> <li>d) Triangles on equal bases and of the same altitude are equal in area.</li> </ul>
---------------------------------	--

### UNIT-15: PROJECTION OF A SIDE OF A TRIANGLE

15.1 Projection of a side of a Triangle	<p>Understand the following theorems along with their corollaries and apply them to solve allied problems.</p> <ul style="list-style-type: none"> <li>a) In an obtuse-angled triangle, the square on the side opposite to the obtuse angle is equal to the sum of the squares on the sides containing the obtuse angle together with twice the rectangle contained by one of the sides, and the projection on it of the other.</li> <li>b) In any triangle, the square on the side opposite to an acute angle is equal to the sum of the squares on</li> </ul>
---	--

	<p>the sides containing that acute angle diminished by twice the rectangle contained by one of those sides and the projection on it of the other.</p> <p>c) In any triangle, the sum of the squares on any two sides is equal to twice the square on half the third side together with twice the square on the median which bisects the third side, (Apollonius' theorem).</p>
--	--

## UNIT-16: INTRODUCTION TO COORDINATE/ANALYTICAL GEOMETRY

16.1 Distance Formula	<p>i) Explain and define coordinate geometry.</p> <p>ii) Derive distance formula to calculate distance between two points given in Cartesian plane.</p> <p>iii) Use distance formula to find distance between two given points.</p>
16.2 Collinear Points	<p>i) Define collinear points. Distinguish between collinear and non-collinear points.</p> <p>ii) Use distance formula to show that three (or more) given points are collinear.</p> <p>iii) use distance formula to show that the given three non-collinear points form:</p> <ul style="list-style-type: none"> <li>• An equilateral triangle,</li> <li>• An isosceles triangle,</li> <li>• A right angled triangle,</li> <li>• A scalene triangle.</li> </ul> <p>iv) Use distance formula to show that four given non-collinear points form:</p> <ul style="list-style-type: none"> <li>• A square,</li> <li>• A rectangle,</li> <li>• A parallelogram.</li> </ul>
16.3 Mid- Point Formula	<p>i) Recognize the formula to find the midpoint of the line joining two given points.</p> <p>ii) Apply distance and midpoint formulas to solve/verify different standard results related to geometry.</p>

## CURRICULUM FOR MATHEMATICS, GRADE-X

Content of scope	Learning outcomes/ skills
<b>All students will be able to</b>	

### UNIT-17: SETS AND FUNCTIONS

17.1 Operations on Sets	i) Recall the sets denoted by $\mathbb{N}, \mathbb{W}, \mathbb{Z}, \mathbb{E}, \mathbb{O}, \mathbb{P}, \mathbb{Q}$ and $\mathbb{R}$ ii) Type of sets and representation of sets iii) Operations on sets <ul style="list-style-type: none"> <li>• Union,</li> <li>• Intersection,</li> <li>• Difference,</li> <li>• Complement.</li> </ul> iv) Symmetric difference of two sets
17.1.2 Properties of Union and Intersection	i) Give formal proof of the following fundamental properties of union and intersection of two or three sets. <ul style="list-style-type: none"> <li>• Commutative property of union,</li> <li>• Commutative property of intersection,</li> <li>• Associative property of union,</li> <li>• Associative property of intersection,</li> <li>• Distributive property of union over intersection,</li> <li>• Distributive property of intersection over union,</li> <li>• De Morgan's laws.</li> </ul> ii) Verify the fundamental property of given sets.
17.1.3 Venn Diagrams	i) Use Venn diagrams to represent <ul style="list-style-type: none"> <li>• Union and intersection of sets,</li> <li>• Complement of a set.</li> <li>• Symmetric difference of two sets.</li> </ul> ii) Use Venn diagram to verify <ul style="list-style-type: none"> <li>• Commutative property of union over intersection of sets,</li> <li>• De Morgan's laws,</li> <li>• Associative laws,</li> <li>• Distributive laws.</li> </ul>

17.1.4 Ordered Pairs and Cartesian Products	<p>i) Recognize order pairs.</p> <p>ii) To form Cartesian products.</p>
17.2 Binary Relations	Define a binary relation and identify its domain and range.
17.3 Functions	<p>i) Define a function and identify its domain, co-domain and range.</p> <p>ii) Demonstrate the following:</p> <ul style="list-style-type: none"> <li>• Into and one-one function (injective function),</li> <li>• Onto function (subjective function),</li> <li>• One-one and onto function (bijective function).</li> </ul> <p>iii) Examine whether a given relation is a function or not.</p> <p>iv) Differentiate between one-one correspondence and one-one function.</p>

## UNIT-18: VARIATIONS

18.1 Ratios, Proportions and Variations	<p>i) Define ratios, proportions and variations (direct and inverse).</p> <p>ii) Find 3<sup>rd</sup>, 4<sup>th</sup> proportions and mean in a continued proportion.</p>
18.2 Theorems on Proportions	<p>Apply theorems of:</p> <ul style="list-style-type: none"> <li>• invertendo,</li> <li>• alternando,</li> <li>• componendo,</li> <li>• dividendo and componendo</li> <li>• dividendo</li> </ul> <p>to find proportions.</p>
18.3 Joint Variations	<p>i) Define joint variations.</p> <p>ii) Solve problems related to joint variations.</p>
18.4 <i>k</i> - Method	<p>i) Use <i>k</i>- Method to prove conditional equalities involving proportions.</p> <p>ii) Solve real life problems based on variations.</p>

## UNIT-19: MATRICES AND DETERMINANTS

19.1 Introduction to Matrices	<p>Define</p> <ul style="list-style-type: none"> <li>• A matrix with real entries and relate its rectangular layout (formation) with representation in real life as well.</li> <li>• Know about the rows and columns of a matrix,</li> <li>• The order/size of a matrix,</li> <li>• Equality of two matrices.</li> </ul>
19.2 Types of Matrices	<p>Define and identify row matrix, column matrix, rectangular matrix, square matrix, zero/null matrix, identity/unit matrix, scalar matrix, diagonal matrix, transpose of a matrix, symmetric (upto three by three, 3 x 3) and skew-symmetric matrices.</p>
19.3 Addition and Subtraction of Matrices	<ol style="list-style-type: none"> <li>i) Know whether the given matrices are conformable for addition and subtraction.</li> <li>ii) Scalar multiplication of a matrix by a real number.</li> <li>iii) Add and subtract matrices</li> <li>iv) Verify commutative and associative laws w.r.t. addition.</li> <li>v) Define additive identity of a matrix.</li> <li>vi) Find additive inverse of a matrix.</li> </ol>
19.4 Multiplication of Matrices (upto two by two, 2 x 2)	<ol style="list-style-type: none"> <li>i) Know whether the given matrices are conformable for multiplication.</li> <li>ii) Multiply two (or three) matrices.</li> <li>iii) Verify associative law under multiplication.</li> <li>iv) Verify distributive laws.</li> <li>v) Verify, with the help of an example that commutative law w.r.t. multiplication does not hold, in general. (i.e., <math>AB \neq BA</math>),</li> <li>vi) Define multiplicative identity of a matrix.</li> <li>vii) Verify the result <math>(AB)^t = B^t A^t</math>.</li> </ol>
19.5 Determinant of a Matrix	<ol style="list-style-type: none"> <li>i) Define the determinant of a square matrix.</li> <li>ii) Finding the value of determinant of a matrix.</li> <li>iii) Define singular and non-singular matrices.</li> <li>iv) Define minors and co-factors</li> </ol>

19.6 Multiplicative Inverse of a Matrix	i) Define adjoint of a matrix. ii) Find the multiplicative inverse of a non-singular matrix $A$ and verify that $AA^{-1} = I = A^{-1}A$ , where, $I$ is the identity matrix. iii) Use the adjoint method to calculate inverse of a non-singular matrix. iv) Verify the result $(AB)^{-1} = B^{-1}A^{-1}$ .
19.7 Solution of Simultaneous Linear Equations	Solve the system of two linear equations, related to real life problems, in two unknowns using <ul style="list-style-type: none"> <li>• Matrix inversion method.</li> <li>• Cramer's rule.</li> </ul>

## UNIT-20: THEORY OF QUADRATIC EQUATIONS

20.1 Nature of the Square Roots of a Quadratic Equation	i) Define discriminant ( $b^2 - 4ac$ ) of the quadratic expression $ax^2 + bx + c$ . ii) Find the discriminant of a given quadratic equation. iii) Discuss the nature of the roots of a quadratic equation through discriminant. iv) Determine the nature of the roots of a given quadratic equation and verify the result by solving the equation. v) Determine the values of an unknown involved in a given quadratic equation when the nature of its roots is given.
20.2 Cube Roots of Unity and their Properties	i) Find cube roots of unity. ii) Recognize complex cube roots of unity as $w$ and $w^2$ . iii) Verify the properties of cube roots of unity. iv) Use properties of cube roots of unity to solve allied problems.
20.3 Roots and Coefficients of a Quadratic Equation	i) Find the relation between the roots and the coefficients of a quadratic equation. ii) Find the sum and the product of the roots of a given quadratic equation without solving it. iii) Find the value(s) of the unknown involved in a

	<p>given quadratic equation when</p> <ul style="list-style-type: none"> <li>• Sum of roots is equal to a multiple of the product of the roots,</li> <li>• Sum of the squares of the roots is equal to a given number,</li> <li>• Roots differ by a given number,</li> <li>• Roots satisfying a given relation (e.g., the relation <math>2\alpha + 5\beta = 7</math>, where <math>\alpha</math> and <math>\beta</math> are the roots of the given equations),</li> <li>• Both sum and product of the roots are equal to a given number.</li> </ul>
20.4 Symmetric Functions of Roots of a Quadratic Equation	<ol style="list-style-type: none"> <li>Define symmetric functions of the roots of a quadratic equation.</li> <li>Represent a symmetric function graphically</li> <li>Evaluate a symmetric function of the roots of a quadratic equation in terms of its coefficients.</li> </ol>
20.5 Formation of Quadratic Equations	<ol style="list-style-type: none"> <li>Establish the formula,  <math>x^2 - (\text{sum of the roots})x + (\text{product of the roots}) = 0</math>,  to find the quadratic equation of the given roots.</li> <li>form the quadratic equation whose roots, for examples are of the type: <ul style="list-style-type: none"> <li>• <math>2\alpha + 1, 2\beta + 1</math></li> <li>• <math>\alpha^2, \beta^2</math></li> <li>• <math>\frac{1}{\alpha}, \frac{1}{\beta}</math></li> <li>• <math>\frac{\alpha}{\beta}, \frac{\beta}{\alpha}</math></li> <li>• <math>\alpha + \beta, \frac{1}{\alpha} + \frac{1}{\beta}</math></li> </ul> <p>where, <math>\alpha, \beta</math> are the roots of a quadratic equation</p> </li> <li>Find the values of <math>\alpha, \beta</math>, where the roots of an equation are <math>\frac{1}{\alpha}, \frac{1}{\beta}</math></li> </ol>
20.6 Higher Degree Equations reduceable to Quadratic	<ul style="list-style-type: none"> <li>• Solve the cubic equation if one root of the equation is given,</li> </ul>

Form	<ul style="list-style-type: none"> <li>Solve a biquadratic (quartic) equation if two of the real roots of the equation are given.</li> </ul>
20.7 Simultaneous Equations	<p>i) Solve a system of two equations in two variables, when</p> <ul style="list-style-type: none"> <li>One equation is linear and the other is quadratic,</li> <li>Both the equations are quadratic.</li> </ul> <p>ii) Solve the real life problems leading to quadratic equations.</p>

## UNIT-21: PARTIAL FRACTIONS

21.1 Proper, Improper and Rational Fractions	Define proper, improper and rational fractions.
21.2 Resolution of Fraction into its Partial Fractions	<p>Resolve an algebraic fraction into its partial fractions when its denominator consist of</p> <ul style="list-style-type: none"> <li>Non- repeated linear factors,</li> <li>Repeated linear factors,</li> <li>Non- repeated quadratic factors,</li> <li>Repeated quadratic factors.</li> </ul>

## UNIT-22: BASIC STATISTICS

22.1 Frequency Distribution	<p>i) Construct a group frequency table.</p> <p>ii) Construct histograms with equal class intervals.</p> <p>iii) Construct histograms with unequal class intervals.</p> <p>iv) Construct a frequency polygon.</p>
22.2 Cumulative Frequency Distribution	<p>i) Construct a cumulative frequency table.</p> <p>ii) Draw a cumulative frequency polygon.</p>
22.3 Measures of Central Tendency	<p>i) Calculate for (ungrouped and grouped data):</p> <ul style="list-style-type: none"> <li>Arithmetic mean by definition and using deviations from assumed mean,</li> <li>Median, mode, geometrical mean and harmonic mean,</li> </ul> <p>ii) Recognize properties of arithmetic mean.</p> <p>iii) Calculate weighted mean and moving averages.</p> <p>iv) Estimate median, quartiles and mode, graphically.</p>

22.4 Measures of Dispersion	Define, identify and measure range, calculate variance of mean deviation and standard deviation.
-----------------------------	--

## UNIT-23: PYTHAGORAS' THEOREM

23.1 Pythagoras' Theorem	<p>Understand the following theorem along with its corollaries and apply them to solve allied problems.</p> <ol style="list-style-type: none"> <li>In a right-angled triangle, the square of the length of hypotenuse is equal to the sum of the squares of the lengths of the other two sides. (Pythagoras' Theorem).</li> <li>If the square of one side of a triangle is equal to the sum of the squares of the other two sides then the triangle is a right angled triangle, (converse to Pythagoras' Theorem).</li> </ol>
--------------------------	---

## UNIT 24: RATIO AND PROPORTION

24.1 Ratio and Proportion	<p>Understand the following theorems along with their corollaries and apply them to solve allied problems.</p> <ol style="list-style-type: none"> <li>A line parallel to one side of a triangle, intersecting the other two sides, divides them proportionally.</li> <li>If a line segment intersects the two sides of a triangle in the same ratio then it is parallel to the third side.</li> <li>The internal bisector of an angle of a triangle divides the side opposite to it in the ratio of the sides containing the angle.</li> <li>If two triangles are similar, the measures of their corresponding sides are proportional.</li> </ol>
---------------------------	---

## UNIT 25: CHORDS OF A CIRCLE

25.1 Chords of a Circle	<p>Understand the following theorems along with their corollaries and apply them to solve allied problems.</p> <ol style="list-style-type: none"><li>One and only one circle can pass through three non-collinear points.</li><li>A straight line, drawn from the centre of a circle to bisect a chord (which is not a diameter) is perpendicular to the chord.</li><li>Perpendicular from the centre of a circle to the chord bisects it.</li><li>If two chords of a circle are congruent then they will be equidistant from the centre.</li><li>Two chords of a circle which are equidistant from the centre are congruent.</li></ol>
-------------------------	---

## UNIT 26: TANGENTS OF A CIRCLE

26.1 Tangent(s) to a Circle	<p>Understand the following theorems along with their corollaries and apply them to solve allied problems.</p> <ol style="list-style-type: none"><li>If a line is drawn perpendicular to a radial segment of a circle at its outer end point, it is tangent to the circle at that point.</li><li>The tangent to a circle and the radial segment joining the point of contact and the centre are perpendicular to each other.</li><li>The two tangents drawn to a circle from a point outside it are equal in length.</li><li>If two circles touch externally or internally, the distance between their centres is, respectively, equal to the sum or difference of their radii.</li></ol>
-----------------------------	---

## UNIT-27: CHORDS AND ARCS

27.1 Chords and Arcs	<p>Understand the following theorems along with their corollaries and apply them to solve allied problems.</p> <ol style="list-style-type: none"><li>If two arcs of a circle (or of congruent circles) are congruent, then the corresponding chords are equal.</li><li>If two chords of a circle (or of congruent circles) are equal, then their corresponding arcs (minor, major, semi-circular) are congruent.</li><li>Equal chords of a circle (or of congruent circles) subtend equal angles at the centre (at the corresponding centres).</li><li>If the angles subtended by the two chords of a circle (or congruent circles) at the centre (corresponding centres) are equal, the chords are equal.</li></ol>
----------------------	--

## UNIT-28: ANGLE IN A SEGMENT OF A CIRCLE

28.1 Angle in a Segment of a Circle	<p>Understand the following theorems along with their corollaries and apply them to solve allied problems.</p> <ol style="list-style-type: none"><li>The measure of a central angle of a minor arc of a circle is double that of the angle subtended by the corresponding major arc.</li><li>Any two angles in the same segments of a circle are equal.</li><li>The angle<ol style="list-style-type: none"><li>In a semi-circle is a right angle,</li><li>In a segment greater than the semi-circle is less than a right angle, (i.e., an acute angle)</li><li>In a segment less than a semi-circle is greater than a right angle, (i.e., an obtuse angle)</li></ol></li><li>The opposite angles of any quadrilateral inscribed in a circle are supplementary.</li></ol>
-------------------------------------	--

## UNIT-29: PRACTICAL GEOMETRY-CIRCLES

29.1 Construction of Circles	<ol style="list-style-type: none"><li>i) Locate the centre of a given circle</li><li>ii) Draw a circle passing through three given non-collinear points.</li><li>iii) Complete the circle:<ul style="list-style-type: none"><li>• By finding the centre,</li><li>• Without finding the centre, when a part of its circumference is given.</li></ul></li></ol>
29.2 Circles attached to Polygons	<ol style="list-style-type: none"><li>i) Circumscribe a circle about a given triangle.</li><li>ii) Inscribe a circle in a given triangle.</li><li>iii) Escribe a circle to a given triangle.</li><li>iv) Circumscribe an equilateral triangle about a given circle.</li><li>v) Inscribe an equilateral triangle in a given triangle.</li><li>vi) Inscribe an equilateral triangle in a given circle</li><li>vii) Circumscribe a square about a given circle.</li><li>viii) Circumscribe a regular hexagon about a given circle.</li><li>ix) Inscribe a regular hexagon in a given circle.</li></ol>
29.3 Tangents to a Circle	<ol style="list-style-type: none"><li>i) Draw a tangent to a given arc, without using the centre, through a given point <math>P</math>, when <math>P</math> is :<ul style="list-style-type: none"><li>• The middle point of the arc,</li><li>• At the end of the arc,</li><li>• Outside the arc.</li></ul></li><li>ii) Draw a tangent to a given circle from a point <math>P</math>, when <math>P</math> lies<ul style="list-style-type: none"><li>• On the circumference,</li><li>• Outside the circle.</li></ul></li><li>iii) Draw two tangents to a circle meeting each other at a given angle.</li><li>iv) Draw<ul style="list-style-type: none"><li>• Direct common tangent or external tangent,</li><li>• Transverse common tangent or internal tangent to two equal circles,</li></ul></li><li>v) Draw<ul style="list-style-type: none"><li>• Direct common tangent or external tangent,</li></ul></li></ol>

	<ul style="list-style-type: none"> <li>• Transverse common tangent or internal tangent to two unequal circles,</li> </ul> <p>vi) Draw a tangent to</p> <ul style="list-style-type: none"> <li>• To unequal touching circles,</li> <li>• Two unequal intersecting circles,</li> </ul> <p>vii) Draw a circle which touches</p> <ul style="list-style-type: none"> <li>• Both the arms of a given angle,</li> <li>• Two converging lines and passes through a given point between them,</li> <li>• Three converging lines.</li> </ul>
--	--

### UNIT-30: INTRODUCTION TO TRIGONOMETRY

30.1 Measurement of an Angle	<p>i) Measure an angle in sexagesimal system (degrees, minutes and seconds).</p> <p>ii) Convert an angle given in D° M' S" form into decimal form (upto two decimal places) and vice-versa.</p> <p>iii) Define a radian (measure of an angle in circular system) and prove the relationship between radian and degree measures</p>
30.2 Sector of a Circle	<p>i) Establish the rule <math>l = r\theta</math>, where <math>r</math> is the radius of the circle, <math>l</math> the length of the circular arc and <math>\theta</math> is the central angle measured in radians.</p> <p>ii) Prove that the area of the sector of a circle is <math>\frac{1}{2} r^2 \theta</math> or <math>\frac{1}{2} l \theta</math>.</p>
30.3 Trigonometric Ratios	<p>i) Define and identify:</p> <ul style="list-style-type: none"> <li>• General angle (coterminal angles)</li> <li>• Angle in standard position.</li> </ul> <p>ii) Recognize quadrants and quadrantal angles.</p> <p>iii) Define trigonometric ratios and their reciprocals with the help of a unit circle.</p> <p>iv) Recall the values of the trigonometric ratios for <math>45^\circ</math>, <math>30^\circ</math>, <math>60^\circ</math>.</p> <p>v) Recognize signs of trigonometric ratios in different quadrants.</p>

	<p>vi) Find the values of remaining trigonometric ratios if one trigonometric ratio is given.</p> <p>vii) Calculate the values of trigonometric ratios for <math>0^\circ</math>, <math>90^\circ</math>, <math>180^\circ</math>, <math>270^\circ</math>, <math>360^\circ</math>.</p>
30.4 Trigonometric Identities	Prove the trigonometric identities and apply them to show different trigonometric relations.
30.5 Angles of Elevation and Depression.	<p>i) Find angles of elevation and depression.</p> <p>ii) Solve real life problems involving angles of elevation and depression.</p>

Draft

## GUIDELINES TO TEXTBOOK AUTHORS

Textbooks aimed at lower levels tend to be inclined more towards learning features than those at higher levels. However, in textbooks writing generally the following aspects may be taken into considerations

1. **The textbook for Mathematics Grade-IX will cover the units 1 to 16.**
2. **The textbook for Mathematics Grade-X will cover the units 17 to 30.**
3. The text book should be in line with the objectives of the National curriculum.
4. The authors should continuously focus on the standards and benchmarks.
5. The author should bring himself to mental level of the students he is writing for.
6. The span of the textbook should be fairly reasonable.
7. The material should be cramped. to make it more digestible, it may be chunked into smaller parts with headings.
8. The textbook is expected to provide accurate and up-to-date information.
9. The text material should be arranged in a logical manner, simple to complex ,familiar to unfamiliar and concrete to abstract.
10. The text material must be free from ambiguities and errors (both mathematical and typographical).
11. The content provided in the text book should not develop wrong and confusing concepts.
12. The text should be clear and concise. It should not give any meaning other than the one intended.
13. Special attention should be paid to geometrical notions; every table; line drawings and graphs should be labeled appropriately.
14. Footnotes and side notes may be inserted whenever necessary.
15. Workout/solved examples should be lucid with solutions in details, giving reasons related to particular ensuing problems in the exercise.
16. A simple and brief exercise should be given on the previous work related to the topic developed to maintain continuity.
17. List of symbols and index should be given at the end of the book to facilitate the students and the teachers.
18. The authors should go through relevant curriculum and the guidelines to the authors before writing the textbooks
19. The authors are requested to provide the answers of the questions in various exercises in the books so that discrepancies are avoided.
20. If possible the author may indicate in the footnote, any website related to a particular topic.
21. Objective type, multiple choice questions (MCQs) may be given at the end of every chapter.
22. Miscellaneous exercise may be given at the end of each chapter.

23. Emphasis should be on applications of the concepts and techniques developed in the text rather than on the rote system.

## **GUIDELINES FOR THE TEACHERS' MANUAL**

Ideally the teachers' manual should come with the textbook. The manual is aimed at informing teachers how the textbook is written and how best to use it to facilitate student learning. It can be seen as a means of helping teachers to develop professionally. It should provide detailed explanation of key concepts and the way to teach a particular topic. Its basic features are as below

The teachers' manual should:

1. Be easy to understand and use.
2. Help teachers teach text and extend activities.
3. Give sequenced instructions for each activity.
4. Include teaching learning resources.
5. Establish a question bank (having questions different from text) and suggest interactive quizzes corresponding to each unit.
6. Involve various up-to-date and relevant teaching strategies and rationale for suggested teaching.
7. Explain how to implement each teaching strategy.
8. Identify constraints and strength of each strategy or activity.
9. Identify resources needed for teaching strategies and extension of activities
10. Expand and develop teachers' rationale of knowledge and skills.
11. Identify assessment strategies.
12. Orientation of authors and reviewers be arranged for a better cohesion.
13. Teachers manual should be made available along with the textbook.
14. Give real life examples with the use of matrices.  
For examples: Connectivity of various stations/cities, manufacturing of different products, census data etc.

## **GENERAL GUIDELINES TO TEXTBOOK BOARD**

1. Orientation sessions/workshops may be arranged for respective teachers to apprise them of the curriculum and relevant textbook.
2. The boards must ensure that the relevance of the curriculum and textbooks is maintained and to make sure that the language should be simple and the material be students' friendly.

3. The boards should arrange the orientation sessions for authors and reviewers for better understanding of the curriculum
4. The reviews of the textbooks be periodically conducted by senior and more qualified teachers

## SCHEME OF STUDY:

### A. ASSESSMENT IN MATHEMATICS

It should be kept in mind that in mathematics a single type of assessment can frustrate students, diminish their self-confidence and make them feel anxious about the subject. In reality the understanding of mathematical concepts encompasses a broad range of abilities. Examples of various templates to assess different abilities are mentioned below

Assessment must include by focusing on a student's ability to:

1. Communicate mathematically.
2. Reason and analyze ; and to think and act in positive ways.
3. Comprehend the key concepts.
4. Evaluate the effectiveness of using different strategies to address the sample problem.
5. Use a variety of strategies to problem solving and to make mathematical connections.
6. Discriminate between relevant and irrelevant attributes of a concept in selecting examples.
7. Integrate and to make sense of mathematical concepts and procedures.
8. Examine real life situations by reasoning mathematically.

Learning of mathematics, being a cumulative process, occurs as experiences to contribute to understanding. Suggested below are the assessment strategies to obtain valid and reliable picture of students' understanding and achievement.

**i) Classroom-based assessments that include:**

- anecdotal records, checklists rating scales, port folios peer and self-assessment

**ii) Teacher-designed test formats that include:**

- Oral examinations
- Assignments (Project Based)
- Multiple-Choice Assessment
- Constructed Responses.

## B. SCHEME OF EXAMINATION:

Separate annual examinations will be conducted for each Grade IX and X by SSC-Examination Boards, so that the burden may not be felt by both the students and teachers. The total marks be equally distributed.

## C. INSTRUCTIONS FOR SSC EXAMINATIONS:

The examining institutions or bodies including all Boards of Intermediate and Secondary Education for the conduct of SSC examinations in the subject of Mathematics should follow instructions as given below.

1. The question papers should be balanced in all respect. Following table, showing weightage to difficulty level of questions, is suggested to be a practicable criterion for a balanced question paper of Mathematics.

Difficulty Level of Questions	Weightage
Easy	15%
Average	70 %
Difficult	15%

2. According to the new Scheme of Studies **150** marks have been allocated to the subject of Mathematics for SSC Examination. There will be two papers (Paper-A and Paper-B) of Mathematics each carrying **75** marks.
  - For **Paper-A**, the examiners will set the questions keeping in view the table (unit-wise weightages for grades IX). The paper will cover units 1-16.
  - For **Paper-B**, the examiners will set the questions keeping in view the table (unit-wise weightages for grades X).The paper will cover units 17-30

## D. UNIT-WISE WEIGHTAGE

### 1. Unit-wise weightage Grade-IX

Unit	Title	Weightage (%)
1.	Real and Complex Numbers	7
2.	Logarithms	5
3.	Algebraic Expressions and Formulas	9
4.	Factorization	9
5.	Algebraic Manipulation	5
6.	Linear Equations and Inequalities	6
7.	Linear Graphs and their Applications	5
8.	Quadratic Equations	8
9.	Congruent Triangles	7
10.	Parallelograms and Triangles	7
11.	Line Bisectors and Angle Bisectors	7
12.	Sides and Angles of a Triangle	5
13.	Practical Geometry – Triangles	3
14.	Theorems Related with Area	5
15.	Projection of a Side of a Triangle	7
16.	Introduction to Coordinate/Analytical Geometry	5

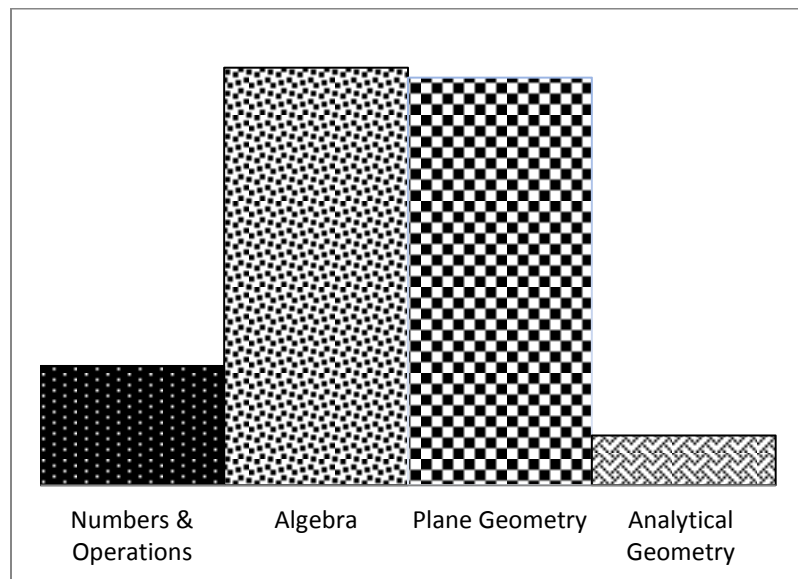
### 2. Unit-wise weightage Grade-X

Unit	Title	Weightage (%)
17.	Sets and Functions	11
18.	Variations	6
19.	Matrices and Determinants	9
20.	Theory of Quadratic Equations	12
21.	Partial Fractions	4
22.	Basic Statistics	9
23.	Pythagoras' Theorem	7
24.	Ratio and Proportion	5
25.	Chords of a Circle	6
26.	Tangents of a Circle	5
27.	Chords and Arcs	5
28.	Angle in a Segment of a Circle	5
29.	Practical Geometry-Circles	6
30.	Introduction to Trigonometry	10

## E. AREA-WISE WEIGHTAGE

### Grade-IX

#### Allocation of Areas



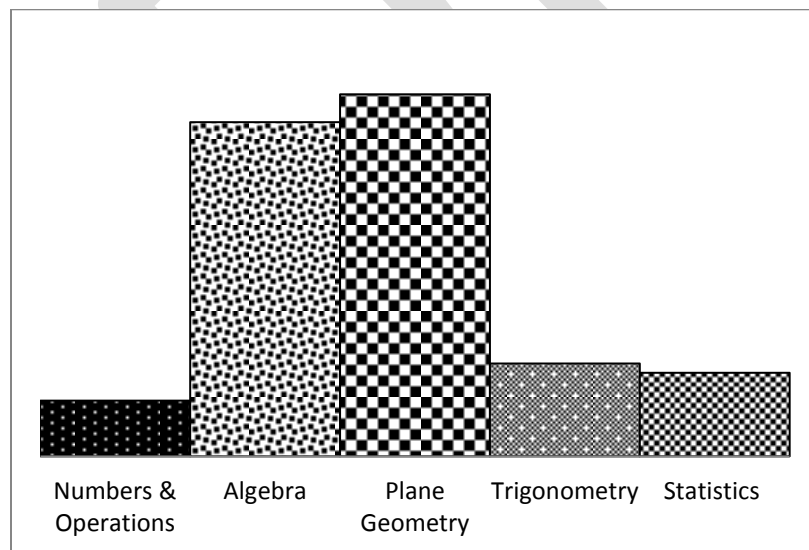
#### Assessment weightage

Area	Weightage (%)
Numbers & Operations	12
Algebra	42
Plane Geometry	41
Analytical Geometry	5

Area	No. of Periods (40 minutes for each)
Numbers & Operations	25
Algebra	88
Plane Geometry	87
Analytical Geometry	10
<b>Total periods</b>	<b>210</b> (6 periods per week)

### Grade-X

#### Allocation of Areas



#### Assessment weightage

Area	Weightage (%)
Numbers & Operations	6 %
Algebra	36 %
Plane Geometry	39 %
Trigonometry	10 %
Statistics	9 %

Area	No. of Periods (40 minutes for each)
Numbers & Operations	12
Algebra	77
Geometry	82
Trigonometry	23
Statistics	16
<b>Total period</b>	<b>210</b> (6 periods per week)

**Members & Co-members of Committee for review of Curriculum & Textbooks for the  
subject of Mathematics for Grades (IX & X) at Secondary level-2017**

1.	Dr. Muhammad Zakauallah Khan, (Rtd.) Prof. University of Sindh. 0314-5167564	Chairman
2.	Mr. Muhammad Saghir Shaikh Consultant (TPM), Reform Support Unit (RSU), Karachi.,0331-3501305	Member
3.	Mr. Muhibullah Shaikh (Rtd.) Teacher, Public School, Hyderabad, 0333-2695890	Member
4.	Mr. Syed Afaq Ahmed Assistant Professor (Mathematics), DETRC, Karachi. 0336-2715375	Member
5.	Mr. Shafiq Ahmed Memon Assistant Professor (Maths), GECE (M) Sukkur, 0334-2905784	Member
6.	Mr. Mahfooz Channa Associate Professor, Government Degree Boys College, Kohsar, Latifabad, Hyderabad. 0300-3248316	Member
7.	Ms. Attia Butto Lecturer, Government Zubaida College, Hyderabad, 0333-1030148	Member
8.	Mr. Pandhi Khan Talpur HM, GHS, Khurshid Colony, Kotri., 0300-3083245, 0300-3083248	Member
9.	Mr. Shoiab Mohsin Assistant Professor, University of Sindh. 0301-3572992	Co-Member
10.	Mr. Muhammad Farooq khan Professor (Rtd), Principal, Government Degree Boys College Kohsar, Latifabad, Hyderabad. 0300-9378021	Co-Member
11.	Mr. Ovais Siddiqui Siraj Lecturer, Sir Syed University of Engg: & Technology, Karachi. 0333-3467890,	Co-Member
12.	Mr. Muhammad Waseem Assistant Professor, Government Degree Boys College, Kohsar, Latifabad, Hyderabad. 0337-8036509	Co-Member
13.	Mr. Aftab Ali Deputy Director, Bureau of Curriculum and Extension Wing, Sindh Jamshoro. 0333-2653528	Member/ secretary

**CURRICULUM FOR MATHEMATICS GRADES I-XII 2006  
DEVELOPMENT TEAM**

**1. Team of Curriculum Writers**

Professor Dr. Muhammad Tahir Chairman (Sciences) National Curriculum Council Ministry of Education, Islamabad	Dr. Malik Muhammad Yousuf Assistant Professor Department of Mathematics Quid-i-Azam, Islamabad
Mr. Saleemullah Assistant Director (Academics)/ Lecturer in Mathematics Federal Directorate of Education, Islamabad	Ms. Tayyaba Saqib Head of mathematics Department The City School, Capital Campus Islamabad

**2. Team of Advisors**

Professor Dr Muhammad Tahir Chairman (Sciences) National Curriculum Council Ministry of Education, ISLAMABAD	Professor Dr M A Rashid Centre for Advanced Mathematics & Physics (CAMP), College of E & ME Campus (NUST) Peshawar Road, RAWALPINDI
Professor Dr Imdad. Hussain Head of Mathematics Department University of Baluchistan QUETTA	Professor Dr Muhammad Aslam Noor Department of Mathematics COMSATS Institute of Information Technology, ISLAMABAD
Professor Dr Muhammad Aslam Butt Department of Mathematics Lahore University of Management Sciences (LUMS), LAHORE CANTT	Professor Dr Syed Arif Kamal Chairman Mathematics Department University of Karachi KARACHI
Professor Dr Gulzar Ali Khan Chairman Mathematics Department University of Peshawar PESHAWAR	Professor Dr Muhammad Shafiq Baig Chairman Mathematics Department University of Azad Jammu & Kashmir MUZAFFARABAD (AJ&K)
Dr Malik Muhammad Yousaf Assistant Professor Department of Mathematics Quaid-i-Azam University, ISLAMABAD	

### 3. Panel of Experts

Professor Dr. Shaban Ali Bhatti Chairman Mathematics Department University of the Punjab, LAHORE	Professor Dr. B.A Saleemi Dean Faculty of Basic & Applied Sciences Air University, PAF Complex, ISLAMABAD
Professor Dr. Ghazala Sadiq Head Department of Humanities and Basic Sciences Institute of Space Technology, ISLAMABAD	Professor Dr. Aftab Khan Dean/Chairman Department of Mathematics Karakoram International University Northern Areas, GILGIT
Professor Dr. Muhammad Aslain Chairman Statistics Department Quaid-i-Azam University, ISLAMABAD	Professor Dr. Faqir Muhammad Chairman Department of Mathematics & Statistics Allama Iqbal Open University, ISLAMABAD
Dr. Tahir Mehmood Chairman Mathematics Department The Islamia University, BAHAWALPUR	Dr. Ghulam Shabbir Assistant Professor of Mathematics GIK Institute of Engineering Sciences & Technology, Topi (District Swabi), NWFP.
Wg Cdr Naseer Ahmad Department of H&S College of Aeronautical Engineering PAF Academy, RISALPUR (NWFP)	Mr. Munawar Din Awan Assistant Educational Advisor Curriculum Wing, Ministry of Education ISLAMABAD
Mr. Abdul Wahid Hashini Directing Officer, Habib Bank MDI Blue Area, ISLAMABAD	Mr. Muhammad Sharif Ghauri Assistant Professor (R) Islamia College Railway Road, LAHORE

### 4. Names of College/School Teachers who contributed

Dr. Akhtar Hussain, Ch Bashir Ahmad, Mr. Abdul Rahim, Mr. Abdul Rashid Mughal, Mr. Abdul Rashid, Mr. Abid Masood, Mr. Aftab Tariq, Mr. Anwar ul Haq, Mr. Asif Javed Ahmad, Mr. Iftikhar Ahmad Cheema, Mr. Javed Iqbal, Mr. Khalid Mehmood, Mr. Mehboob Ahmad, Mr. Muaeed Rabbani, Mr. Muhammad Abbas Haral, Mr. Muhammad Arif, Mr. Muhammad Bukhtiar, Mr. Muhammad Islam Chohan, Mr. Muhammad Khaliq Nazir, Mr. Muhammad Mudassar Niaz, Mr. Muhammad Naeern Mughal, Mr. Muhammad Rafeeq Siddiqui, Mr. Muhammad Rafiq, Mr. Muhammad Saeed Akhtar, Mr. Muhammad Safdar, Mr. Muhammad Saleem Iqbal, Mr. Muhammad Salim Chishti, Mr. Muhammad Siddique, Mr. Muhammad Zahir Ahmad, Mr. Mumtaz Hussain, 1W Mushtaq Ahmad, Dr. Naveed Jamil Malik, Mr. Nadeem. Safdar, Mr. Nasrullah Khan, Mr. Obaid ur Rehman, Mr. Riaz Ahmad Bhatti, Mr. Sajad Akhtar Mughal, Mr. Sardar Muhammad, Mr. Sarwar Nazir, Mr. Shafi Sial, Mr. Shaukat Hussain, Mr. Tariq Ehsan, Dr. Tehsin Jaffar, Mr. Walayat Shah, Mr. Zaheer

Ahmad, Mr. Zakir Ulah Butt, Mr. Zulfiqar Ali, Ms. Arntul Hanif Javeed, Ms. Aneela Ajaib, Ms. Asfa Naseem, Ms. Farhat Mansoor, Ms. Hafsa Jabeen, Ms. Mamunah Butt, Ms. Nabeela Azad, Ms. Naheed Jamal, Ms. Nasira Qureshi, Ms. Rehana Farhat, Ms. Rubina Rahat, Ms. Sadia Ahmad, Ms. Saeeda Nasrin Butt, Ms. Saeeda Parveen, Ms. Sajida Javed, Ms. Saijadia Akram, Ms. Shafaat, Ms. Shagufta Tayyab, Ms. Shaista Batool, Ms. Talat Abbas, Sayyeda Moghees Bokhari, Syed Intizar Abbass and Syed Sadaat Hassan.

Draft



GOVERNMENT OF SINDH  
SCHOOL EDUCATION DEPARTMENT  
Karachi, dated, the 28<sup>th</sup> April, 17

**NOTIFICATION**

**SO(G-I)SED/HCW/103/2017:** School Education Department, Government of Sindh has been pleased to constitute a Review Committee for review of Curriculum and Textbooks for Subject of Mathematics Grade (IX-X) at secondary level with following composition and ToRs.

**Committee:**

1.	Dr. Muhammad ZakaUllah , Rtd. Prof. Sindh University	Chairman
2.	Mr. MuhammadSaghir Shaikh Consultant (TPM), Reform Support Unit (RSU) Karachi,	Member
3.	Mr. Muhibullah Shaikh (Rtd), Public School Hyd	Member
4.	Mr. Syed Afaq Ahmed, Assistant Professor, DETRC, Karachi	Member
5.	Mr. ShafiqMemon, Assistant Professor (Maths), GECE (M) Sukkur	Member
6.	Mr. MahfoozChanna Associate Professor, Government Degree Boys College Kohsar, Latifabad, Hyd.	Member
7.	Ms. AtiaBhuto, Lecturer, Govt. Zubaida College,Hyd	Member
8.	Mr. Pandhi Khan Talpur (working Teacher) HM, GHS, Khurshid Colony Kotri.	Member
9. ✓	Mr. Aftab Ali, Bureau of Curriculum and Extension Wing Sindh Jamshoro,	Member/ Secretary

**ToRs:**

1. Review the National Curriculum 2006 and suggest changes in it in light of Provincial needs/ requirements and context.
2. Share innovative ideas for improving curriculum with addition and deletion of the text
3. Review the Textbook with reference to:
  - a) The Revised National Curriculum 2006.
  - b) Subject- wise Standards, Benchmarks and learning competencies.
  - c) Age relevance and students friendliness.
  - d) Free from linguistic and typographical errors.
  - e) Respecting diversity and be free from Gender, Ethnic, Religious, Cultural, and Occupational biases
  - f) Inclusion of provincial specific contents-personalities, monuments, history etc.
  - g) Life skill and sportsmanship based.

**SO(G-I)SED/HCW/103/2017:**

**-SECRETARY TO GOVERNMENT OF SINDH-  
Karachi, Dated: 28<sup>th</sup> April, 2017**

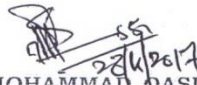
A copy is forwarded for information and necessary action to: -

1. The Director, Bureau of Curriculum & Extension Wing Sindh, Jamshoro.
2. The Chairman, Sindh Textbook Board, Jamshoro.
3. The Head of Curriculum Wing, Schools Education Department, Government of Sindh, Karachi.
4. The Chairman/Members of the Committee
5. The Registrar of Concerned University.
6. The P.S to the Secretary, School Education Department.
7. Official website.
8. Office order file



SINDH EDUCATION &  
LITERACY DEPARTMENT



  
(MOHAMMAD QASIM ABBASI)  
SECTION OFFICER (G-III)



Tel: 022-9213406  
Fax: 022-2771179  
Email: bcews@yahoo.com

Government of Sindh  
School Education Department  
Bureau of Curriculum and Extension Wing Sindh Jamshoro

No. BCEW / DD (Maths) / 2340 / 2017

Dated: 03-05-2017

To

1.	Dr. Muhammad Zakaullah Khan, Rtd. Prof. Sindh University. 03145167564	Chairman
2.	Mr. Muhammad Saghir Shaikh Consultant (TPM), Reform Support Unit (RSU) Karachi. 03313501305	Member
3.	Mr. Muhibullah Shaikh, (Rtd), Public School Hyderabad. 03332695890	Member
4.	Mr. Syed Afaq Ahmed, Assistant Professor, (Maths), DETRC, Karachi. 03362715375	Member
5.	Mr..Shafiq Ahmed Memon, Assistant Professor (Maths), GECE (M) Sukkur. 03342905784	Member
6.	Mr. Mahfooz Channa, Associate Professor, Government Degree Boys College Kohsar, Latifabad, Hyderabad. 03003248316	Member
7.	Ms. Attia Butto, Lecturer, Government Zubaida College Hyderabad. 03331030148	Member
8.	Mr. Pandhi Khan Talpur , HM, GHS, Khurshid Colony Kotri. 03003083245, 03003083248	Member
9.	Mr. Aftab Ali, Deputy Director Bureau of Curriculum and Extension Wing Sindh Jamshoro. 03332653528	Member/ Secretary

**SUBJECT: Review of Curriculum for Mathematics Grade IX-X**

School Education Department, Government of Sindh has been pleased to constitute a Review Committee for review of Curriculum & Textbooks for Subject of Mathematics Grade (IX–X) at secondary level vide Notification NO: SO(G-I)SED/HCW/ 103 / 2017 Dated: 28<sup>th</sup> April 2017, Keeping in view your expertise, skills and experience in the subject you have been appointed as Chairman / Member of review committee.

Bureau of Curriculum & Extension Wing Sindh, Jamshoro has arranged a workshop/ meeting of the review committee for review of curriculum of Mathematics Grade (IX–X) from 7<sup>th</sup> to 12<sup>th</sup> May 2017 (Six days, including Sunday) from 9-00 am to 4-00 pm at Government Elementary College of Education (Men) Hyderabad.

We would like to request you to make it convenient to attend above meeting/workshop as per schedule. Your cooperation in this regard would highly be appreciated.

**TORs.**

1. Review the National Curriculum 2006 and suggest changes in the light of Provincial needs/ requirements and context.
2. Share innovative ideas for improving curriculum with addition and deletion of the text
3. Review the Textbooks with reference to:
  - a. Revised National Curriculum 2006
  - b. Subject-wise Standards, Benchmarks and learning outcomes
  - c. Age relevance and learner friendliness
  - d. Free from linguistic and typographic errors.
  - e. Respecting diversity and be free from Gender, Ethnic, religious, Cultural and Occupational Biases.
  - f. Inclusion of provincial specific contents, personalities, monuments, history etc
  - g. Life skills and sportsmanship.

MUSHTAQUE AHMED SHAHANI  
DIRECTOR

Cc to:

1. P.S to Secretary, School Education Department, Government of Sindh, Karachi.
2. P.S to Secretary, College Education Department, Government of Sindh, Karachi.
3. Chief Program Manager, Reform Support Unit, School Education Department, Government of Sindh, Karachi.
4. Dr. Fouzia Khan, Head Curriculum Wing, School Education Department, Government of Sindh, Karachi.
5. Chairman, Sindh Textbook Board, Jamshoro.
6. Regional Director, Hyderabad Region, Hyderabad.
7. Additional Director, Teachers Training Institution Sindh Hyderabad.
8. Principal, Govt. Degree Boys College Cohsar, Latifabad, Hyderabad.
9. Head Master, Government High School, Khursheed Colony, Kotri.
10. Principal, GECE Darsano Chhano, Malir Karachi.
11. Principal, Government Elementary College of Education (Men) Hyderabad/ Sukkur.
12. Deputy Director, DETRC Qasimabad, Karachi.
13. Accounts Officer, BCEW Sindh, Jamshoro.
14. Office File.



**ASSISTANT DIRECTOR (ESTABLISHMENT)**





Government of Sindh  
Schools Education Department



Bureau of Curriculum & Extension  
Wing Sindh At Jamshoro

E.Mail. [estbcews@gmail.com](mailto:estbcews@gmail.com) Tel: 022-9213405-6

Website [www.bcews@yahoo.com](http://www.bcews@yahoo.com) Fax: 022-2771179

No: BC/EXT/AD (E&A)/2353 /2017

Dated. 05-5.2017

To

1. Professor Muhammad Farooq Khan  
(Rtd), Principal Government Degree Boys  
College Kohsar, Latifabad, Hyderabad.
2. Mr. Shoaib Mohsin  
Assistant Professor  
University of Sindh Jamshoro.
3. Mr. Ovais Siraj  
Lecturer, sir Syed university of Engg: & Technology  
Karachi.
4. Muhammad Waseem  
Assistant Professor  
Government Degree Boys College Kohsar, Latifabad,  
Hyderabad.

Subject: - REVIEW OF CURRICULUM FOR MATHEMATICS GRADE IX-X.

The Bureau of Curriculum & Extension Wing Sindh Jamshoro is going to organize the workshop/ meeting of the review committee for review of Curriculum of Mathematics Grade IX-X from 7<sup>th</sup> to 12<sup>th</sup> May 2017 (6 days including Sunday) from 9:00 am to 04:00 pm at Government College of Education (Men) Hyderabad. In this regard Schools Education Department, Government of Sindh has already constituted the review committee for the subject as mentioned above.

Keeping in view your expertise, skills and experience in the subject, the Chairman of Mathematics committee has suggested your name to work with the committee as coopt member during review process.

We would like to invite you to make it convenient to attend the above meeting / workshop as per schedule and venue mentioned above. Your cooperation in this regard would highly be appreciated.

MUSHTAQUE AHMED SHAHANI  
DIRECTOR

Cc.to

1. The Additional Director, Teachers Training Institutions, Sindh Hyderabad.
2. The Chairman Review Committee of Mathematics subject.
3. The Secretary Review Committee of Mathematics subject.
4. Accounts Officer, BOC Jamshoro.