Proposed Syllabus for Karnataka-Mathematics

Standard IX

I Arithmetic

Unit 1. <u>Square-root</u>

Finding the square-root of a perfect square number of at most 5 digits using division method; finding the square-root of a decimal number by division method; finding the square-root of a number which are not perfect squares like 2, 3, 5 up to 3 decimal places; learning the process of moving nearer to the square-root; verbal problems on square-roots.

Unit 2. <u>Real Numbers</u>

Basic properties of real numbers: closure, commutativity, associativity, distributivity, existence of additive identity, existence of additive inverse, existence of multiplicative identity, and existence of multiplicative inverse for non-zero real numbers; also order property(comparing one real number with another); non-negativity of the square of a real number; stress to be given for identifying rational numbers as those with recurring decimal expansion and irrationals as those with non-recurring decimal expansion.

Unit 3. <u>Surds</u>

Definition; order and radicund; index form; pure and mixed surds, and their mutual conversion; like and unlike surds; representing $\sqrt{2}$, $\sqrt{3}$, $\sqrt{5}$ on the number line (assuming Pythagoras' theorem); knowing the position of $\sqrt{n-1}$ on the number line, to represent $\sqrt{n}$.

Unit 4. <u>Sets</u>

Set operations like union, intersection,; difference of sets; complement of a set; symmetric difference; representing all these using Venn diagram.

Standard X

I Arithmetic

Unit 1. <u>Numbers</u>

Euclid's lemma: given an integer a and a positive integer b, there unique exist integers k and r such that $a = bk + r$, where $0 \le r < b$; (This has been observed by the students, but formalised here.) Fundamental theorem of Arithmetic: any positive integer $n > 1$ can be expressed as a product of powers of prime numbers. (stress to be given to the fact that this factorisation is essentially unique in the sense that except for the order the prime powers are uniquely determined); the above properties without formal proof. As corollaries, the following to be proved: (i) if a prime divides the product of two integers, then it divides at least one of them, and (ii) if a divides bc and HCF$(a, b) = 1$, then a divides c. Proof of irrationality of $\sqrt{2}$, $\sqrt{3}$ and $\sqrt{5}$ using this.

Unit 2. <u>Sets</u>

Revision of set operations(union, intersection, set difference, complement, symmetric difference); properties of set operations: commutativity and associativity of union; commutativity and associativity of intersection; distributivity of union and intersection; DeMorgan's laws; relation between the number of elements in two sets to the number of elements in their union and intersection(principle of inclusion-exclusion): $n(A)+n(B) = n(A\cup B)+n(A\cap B)$.

Unit 3. <u>Progressions</u>

Concept of a sequence; Arithmetic progression: n-th term; sum of n terms of an AP; problems based on this; Geometric progression: n-th term; sum to n terms; sum of an infinite GP, when the common ratio $|r| < 1$; Harmonic progression: n-th term; arithmetic, geometric and harmonic mean of two positive real numbers; relation among them(AM $\ge$ GM $\ge$ HM); a simple proof based on $x^2 \ge 0$ for any real number x.

Unit 5. Statistics

Mean, median, mode of grouped and un-grouped data, a review; range; quartile deviation and mean deviation for a given grouped and un-grouped data; graphical representation; construction and interpretation of histograms of varying width, ogives and frequency polygons; review of random experiments leading to the concept of *chance* or *probability*.

II Commercial Mathematics

Unit 1. Banking

Savings bank account; pass book and challan; cheques and drafts; calculation of interest on deposits in a savings bank account.

Unit 2. Compound interest

Definition of compound interest; difference between simple interest and compound interest; calculation of compound interest using ready recknors; derivation of compound interest formula; problems using formula.

Unit 3. Hire purchase and Installment

Meaning of hire purchase and installment buying; difference between them; calculation of interest in installment buying; some simple problems on how to calculate equated monthly installment (EMI).

Unit 4. Proportion

Meaning of proportion; general form; types-direct, inverse, compound proportions; Problems on time and work involving proportions.

Unit 4.

Permutation, Combination and Probability

Fundamental principle of counting; meaning of permutation; meaning of combination; notations for permutation and combination; difference between permutation and combination; problems based on these principles; random experiment; event; sample space; types of events(mutually exclusive, complementary, certain, impossible); definition of probability; problems on probability based on permutation and combination.

Unit 4. Statistics

Standard deviation of grouped and un-grouped data; calculation of standard deviation by direct method; coefficient of variation; construction and interpretation of pie-charts.

III Algebra

Unit 1. Multiplication

Product of three binomials $(x+a)(x+b)(x+c)$ and related identity; identities for $(a+b)^3$, $(a-b)^3$; product of two trinomials $(a+b+c)^2$; conditional identities.

Unit 2. Factorisation

Standard identities: $a^2 - b^2 = (a-b)(a+b)$; $a^3 + b^3 = (a+b)(a^2 - ab + b^2)$; $a^3 - b^3 = (a-b)(a^2 + ab + b^2)$; factorisation using these identities; factorisation of a trinomial by splitting the middle term; involved problems on these identities.

Unit 3. HCF and LCM

Definition of HCF and LCM; finding HCF and LCM of binomials and trinomials using factorisation

Unit 4. Division

Division of a monomial by a monomial; division of a polynomial by a binomial; division of a polynomial by a trinomial.

Unit 5. Simultaneous Linear Equations

Elimination method; word problems involving simultaneous equations; graph of the equation $ax + by = c$ (stress to be given to the fact that it represents a straight line in plane); solution of two simultaneous linear equations by drawing their graphs.

Unit 6. Variation

Definition; symbolic representation; constant of variation; types of variation - direct, inverse and compound; problems involving variation.

II Algebra

Unit 1. Surds

Like and unlike surds; addition, subtraction and multiplication rule(with simple problems); rationalisation of simple surds.

Unit 2. Polynomials

Division of one polynomial by another; concept of degree; synthetic division method; remainder theorem: $p(x) = (x - a)h(x) + p(a)$.

Unit 3. Quadratic equations

Meaning of a quadratic expression and a quadratic equation; simple problems on pure and adfected equations; solution by factorisation and its limitation; solution using formula (a formal derivation is needed); relation between roots and coefficients; discriminant and nature of roots; graphs of quadratic expressions(include some laws of Physics here to emphasise the importance of quadratic graphs); nature of quadratic expressions in terms of associated discriminant; factorising a quadratic expression using roots; forming quadratic equation, given its roots; graphical method of solving a quadratic equation; limitation of graphical method; word problems leading to quadratic equations.

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Appendix. Proofs in Mathematics Concept of a proof; statement and its validity; axiom/postulates in Mathematics through familiar examples(drawing examples from geometry); the concept and nature of a proof(deductive nature based on the assumptions, the hypothesis and the logical structure); how to write a proof; stress on the fact that verification is not a proof; examples from various topics; ($n^2 + n + 41$ is a prime for $n = 1, 2, 3, \cdots, 40$, but not a prime for $n = 41$.) disproving a statement by a *counter example*; different types of proofs: deductive and proof by contradiction; converse of a statement; stress on that the validity of a statement does not imply the validity of its converse.

Appendix. Mathematical Modelling The concept of modelling; aims of modelling; real life situations leading to models; setting up hypothesis and looking for a model satisfying the hypothesis; solving the problem after setting up an appropriate model; reinterpretation of the problem in terms of the solution obtained by the model; examples from commercial mathematics leading to mathematical models.

General Suggestions:

1. Please include large number of multiple choice questions at the end of each chapter.

2. Give equal weightage to problems on a theorem, its converse and corollaries.

3. Include some harder problems at the end of each chapter to challenge students. These may starred and need not be worked out in a class room.

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Unit 4. Sets

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IV Geometry

Unit 1. Polygons

Meaning of a polygon; interior and exterior angles; convex and concave polygons; regular and irregular polygons; the sum of interior angles of a polygon(both for convex and concave polygons); sum of the exterior angles; inscribing a regular polygon of n sides in a circle, for $n = 3, 4, 5, 6, 8$.

Unit 2. Quadrilaterals

Revision of basics of quadrilaterals: Definition; sides, angles and diagonals. Properties of quadrilaterals; construction of quadrilaterals given any 5 elements; area of a quadrilateral; types of quadrilaterals: parallelogram, rhombus, trapezium; construction of a parallelogram (given adjacent sides and an angle; adjacent sides and a diagonal); construction of a rhombus (given two diagonals; one side and one diagonal); construction of a trapezium (given four sides; parallel sides and the altitude); area of a parallelogram; area of a rhombus; area of a trapezium.

Unit 3. Theorems and problems on parallelogram

Theorem: Each diagonal of a parallelogram divides the parallelogram in to two congruent triangles. The diagonals of a parallelogram bisect each other.

Corollaries this result.

Theorem : Two parallelograms standing on the same base and between the same parallels have same area.

Theorem : (Mid-point theorem) The line joining the mid-points of any two sides of a triangle is parallel to the third side and equal to half the third side. Conversely, if a line joining two points on two sides of a triangle is parallel to the third side and has length equal to half the third side, then it must be passing through the mid-points.

Some riders on each of these theorems.

Unit 4. Circles

Revision of basic notions (definition; radius; diameter; chord arc; angle at the centre subtended by an arc; angle at a point on the circle subtended by an arc; chord); a chord divides the circle in to two arcs, minor and major arc; properties of chords (observation that perpendicular from the centre bisects a chord, using practical work); equal chords are equidistant from the centre and4 its converse(again by practical work).

III Geometry

Unit 1. Triangles

Similarity of triangles; basic proportionality theorem(Thale's theorem); a formal proof using areas;

Theorem: If two triangles are equiangular, their corresponding sides are proportional.

Theorem: If two triangles are similar, then the ratio of their areas is equal to the square of the ratio of any two corresponding sides.

Revision of right-angled triangles leading to Pythagoras' theorem.

Theorem: (Pythagoras) In a right-angled triangle, the square on the hypotenuse is the sum of the squares on the other two sides.

Problems based on Pythagoras theorem.

Theorem: (Converse of Pythagoras theorem) If in a triangle, the square on one side is equal to the sum of the squares on the remaining two sides, then the angle opposite to the larger side is a right-angle.

Problems based on this result.

Unit 2. Circles

Meaning of tangent; point of contact; properties of a tangent: radius drawn from the point of contact of a tangent to the circle is perpendicular to the tangent – converse of this statement(no proof, only verification). Meaning of touching circles – touching externally and touching internally; common tangents – direct and transverse.

Theorem: If two circles touch each other, then the centres and the point of contact are collinear.

Theorem: The tangents drawn from an external point to a circle are (i) equal, (ii) equally inclined to the line joining the point to the centre, and (iii) subtend equal angles at the centre.

Unit 3. Constructions

Construction of chord of given length; verification of the properties: (i) equal chords are equi-distant from the centre; (ii) angles in the same segment are equal; (iii)angles in the major-segment are acute angles; angles in the minor-segment are obtuse angles; and angles in the semi-circle are right-angles.