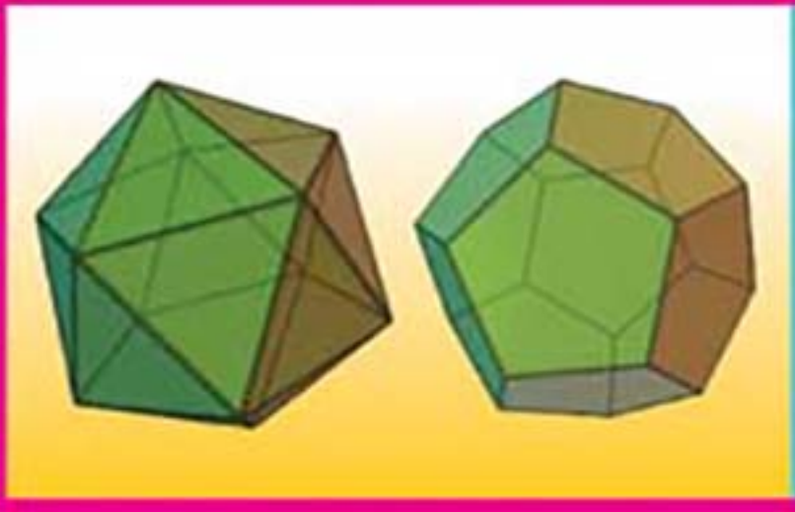
S. Chand's

Revised Edition

ICSE MATHEMATICS

BOOK II

FOR CLASS X



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ANUBHUTI GANGAL

S. CHAND

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ICSE MATHEMATICS

BOOK II

FOR CLASS X

Strictly according to the latest Syllabus for ICSE (Class X) prescribed by the Council for the Indian School Certificate Examinations, New Delhi.

S. Chand's
ICSE MATHEMATICS

BOOK II
FOR CLASS X

Including Question Paper of 2014

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PREFACE TO THE REVISED EDITION

The book has been thoroughly revised keeping in mind the requirements of the latest syllabus and updated by including questions of the ICSE Board Examination Papers up to 2011 at relevant places.

The following chapters have been recast / re-written to cover all aspects of the new syllabus and also to include solved examples and unsolved problems of all types:

- **Compound Interest**
- **Sales Tax and VAT**
- **Banking**
- **Circle**–Chapters 16, 17, 18 and 19 have been merged as it was felt that since all the chapters deal with various properties of circle and are inter-related, it will be easier to understand them if they are studied together.
- **Mensuration**–Chapters 21 and 22 on Right Circular Cone and Sphere have been merged.

AUTHORS

PREFACE TO THE FIRST EDITION

This book has been written for those students who are preparing for the ICSE examination. It follows the latest syllabus.

The Council for Indian School Certificate Examination has released the New Syllabus on Mathematics for ICSE classes and bifurcated the same into two parts—one for Class IX and the other for Class X. The examination at the end of Class IX will be conducted internally by the Member Schools and that at the end of Class X externally by the Council. Questions from the syllabus covered in Class IX will not be asked in the examination for Class X, though the knowledge acquired in Class IX will be needed for the examination for Class X.

To facilitate teaching in the classes and to reduce the mental load of the students, it was thought advisable that the existing well-known book entitled *''A Complete Course in ICSE Mathematics''* by the authors be replaced by two composite books—one for Class IX and the other for Class X, covering the entire syllabus separately for the two classes. The new syllabus for Class IX will be effective from March, 1993 and that for Class X will come into force automatically from March, 1994. The first examination for Class X will be held in March, 1995. Last year we released the first part for Class IX which covers the complete new syllabus and the second part for Class X is being released now. The basic features remain the same as in the existing book, referred to above, by the authors. Most of the subject matter in the new books has been taken from the existing book.

In the process of writing these books, we have kept in mind the needs of both the teachers and the taught, and we hope that they will find it simple and interesting. Throughout the books, the guiding principle has been to help the student to think in as natural a way as possible, so that there is least possible pressure on his memory. In other words, endeavour has been made to put always the horse before the cart, so that the student is led to the goal without experiencing any difficulty, whatsoever, on the way.

The special features of these books are :

1. The books take full advantage of the clarity and consistency of modern terminology.
2. The development is logical, and the preparation of each new idea is based on the preceding material.
3. The clearly developed textual explanations are followed by appropriate solved examples.
4. The mathematical language is kept precise and correct.
5. Each chapter opens up with a photograph and short life-sketch of a renowned mathematician.
6. A variety of **Enrichment Material** has been provided at the end of each chapter.
7. **Historical Notes** have been interspersed throughout the text.
8. The occasional section **`Just for Fun'** provides a lighter touch.
9. The books reflect the authors' conviction that one learns mathematics by doing mathematics and that a proper balance between theory and practice is essential for genuine understanding.
10. The books use **S.I. Units.**
11. Great pains have been taken to present the subject matter in a very easy-to-understand and easily comprehensible manner. To achieve this, we had sometimes to sacrifice brevity and give detailed explanations to bring home to the students the finest aspects of every topic.
12. The treatment of '**Statistics**' is very exhaustive and correct as it should be.
13. All methods have been copiously illustrated by the solved examples and all questions in the Exercises have been carefully graded. All articles and figures have been numbered in the decimal system. For example, Article 13.05 means Article 5 in Chapter 13.
14. Miscellaneous exercises have been given here and there and they include questions from recent ICSE papers. They provide a great variety for revision and practice.

We earnestly hope that the books in the present form will fully fulfil the needs of the students for whom they are meant.

We make no claim to originality. The matter is entirely the work of others and the manner alone is our own. We shall be happy to receive criticism if thereby we may learn more. We acknowledge our debt to all authors consulted in the preparation of these books.

We are grateful to Shri Ravindra K. Gupta, Director S. Chand & Co. Ltd. who took great pains in the production of these books in the present form and who has spared no efforts in avoiding misprints.

AUTHORS

A NOTE TO THE STUDENTS

The following suggestions will help the students learn mathematics :

1. Do not try to read mathematics rapidly. In fact, force yourself to go slowly. A book on mathematics should not be read in the same way as a novel or a history book.
2. Merely reading a book on mathematics is not sufficient. Mathematics can be learnt only by doing the sums.
3. It may not be possible to grasp fully some of the ideas by reading just once. You may have to read again and again to master completely some of the sections.
4. You must ask your teacher to help you if you fail to understand the subject matter. Keep a pencil and paper handy for making a note of your difficulties. *Don't be afraid of asking your teacher for help.* A good teacher will always be too glad to help you.
5. Try to understand definitions and principles. Try to restate them in your own words. Mathematical ideas not understood properly cannot be used correctly.
6. If you fail to solve a sum, study the subject matter again or the solved examples.
7. Do your work neatly and systematically. Many mistakes in mathematics result from poor and rough writing.
8. There is nothing like *rough* work in mathematics. What you call rough work is in fact a part of the working. All working must be shown while doing a sum.
9. Mistakes pointed out in your work by your teacher are more important than the work itself. Before doing the next home work, corrections in the previous home work *must* be done.
10. Lastly, do not lose heart too soon. Learning is a result of effort and perseverance.

AUTHORS

INDIAN CERTIFICATE OF SECONDARY EDUCATION EXAMINATION
SYLLABUS IN MATHEMATICS FOR CLASS – X

*There will be **one** paper of **two and a half** hours duration carrying 80 marks and Internal Assessment of 20 marks.*
*The paper will be divided into **two** sections. Section I (40 marks) and Section II (40 marks).*
***Section I :** Will consist of compulsory short answer questions.*
***Section II :** Candidates will be required to answer **four** out of **seven** questions.*

1. Commercial Mathematics

(*i*) Compound Interest

(*a*) Compound Interest as a repeated Simple Interest computation with a growing Principal. Using this in computing Amount over a period of 2 or 3 years.

(*b*) Use of formula $A = P\ (1 + r\ /\ 100)^n$. Finding *C.I.* from the relation $C.I. = A - P$.

- Interest compounded half-yearly included.
- Using the formula to find one quantity given different combinations of *A, P, r, n, C.I.* and *S.I.*, problems involving difference between *C.I.* and *S.I.* included.
- Rate of growth and depreciation.

Note : Paying back in equal instalments, being given rate of interest and instalment amount, **not included.**

(*ii*) Sales Tax and Value Added Tax

Computation of tax including problems involving discounts, list-price, profit and loss, basic/cost price including inverse cases.

(*iii*) Banking

(*a*) Types of accounts. Idea of Savings Bank Account : computation of interest for a series of months.

(*b*) Recurring Deposit Accounts : computation of interest using the formula :

$$S.I. = P\frac{n(n+1)}{2\times 12}\times\frac{r}{100}.$$

(*iv*) Shares and Dividends

(*a*) Face/Nominal Value, Market Value, Dividend, Rate of Dividend, Premium.

(*b*) Formulae

- Income = number of shares × rate of dividend × FV
- Return = (Income / Investment) × 100

Note : Brokerage and fractional shares **not included.**

2. Algebra

(*i*) Linear Inequations

Linear Inequations in one unknown for $x \in N, W, Z, R$.

- Solving algebraically and writing the solution in set notation form.
- Representation of solution on the number line.

(*ii*) Quadratic Equations

(*a*) Quadratic equations in one unknown. Solving by :

- Factorisation
- Formula

(*b*) Nature of roots

Two distinct real roots if $b^2 - 4ac > 0$.
Two equal roots if $b^2 - 4ac = 0$
No real roots if $b^2 - 4ac < 0$.

(*c*) Solving problems.

(*iii*) Reflection

(*a*) Reflection of a point in the lines $x = 0$, $y = 0$, $x = a$, $y = a$, the origin.

(*b*) Reflection of a point in the origin.

(*c*) Invariant points.

(*iv*) Ratio and Proportion

(*a*) Duplicate, triplicate, sub-duplicate, sub-triplicate, compounded ratios.

(*b*) Continued proportion, mean proportion.

(*c*) Componendo and dividendo, alternendo and invertendo properties.

(*d*) Direct applications.

(*v*) Factorization

(*a*) Factor Theorem

(*b*) Remainder Theorem

(*c*) Factorising a polynomial completely after obtaining one factor by Factor Theorem.

Note : $f(x)$ not to exceed degree 3.

(*vi*) Matrices

(*a*) Order of a matrix. Row and column matrices.

(*b*) Compatibility for addition and multiplication.

(*c*) Null and Identity matrices.

(*d*) Addition and subtraction of 2×2 matrices.

(*e*) Multiplication of 2×2 matrix by

- a non-zero rational number
- a matrix

(*vii*) Coordinate Geometry

Coordinates expressed as (x, y). Distance between two points, section and mid-point formula, concept of slope, equation of a line, various forms of straight lines.

(*a*) Distance formula

(*b*) Section and mid-point formula (Internal section only, co-ordinates of the centroid of a triangle included).

(*c*) Equation of a line

- Slope – intercept form

  $y = mx + c$

- Two-points form

  $(y - y_1) = m\,(x - x_1)$

  Geometric understanding of 'm' as slope/gradient/tan θ where θ is the angle the line makes with the positive direction of the x-axis.

  Geometric understanding of c as the y-intercept/the ordinate of the point where the line intercepts the y-axis/ the point on the line where $x = 0$.

- Conditions for two lines to be parallel or perpendicular. Simple applications of all of the above.

3. Geometry

(*i*) Symmetry

(*a*) Lines of symmetry of an isosceles triangle, equilateral triangle, rhombus, square, rectangle, pentagon, hexagon, octagon (all regular) and diamond-shaped figure.

(*b*) Being given a figure, to draw its lines of symmetry. Being given part of one of the figures listed above to draw the rest of the figure based on the given lines of symmetry (neat recognizable free hand sketches acceptable).

(*ii*) Similarity

Axioms of similarity of triangles. Basic theorem of proportionality.

(*a*) Areas of similar triangles are proportional to the squares on corresponding sides.

(*b*) Direct applications based on the above including applications to maps and models.

(*iii*) Loci

Definition, Meaning, Theorems based on Loci.

(*a*) The locus of a point equidistant from a fixed point is a circle with the fixed point as centre.

(*b*) The locus of a point equidistant from two intersecting lines is the bisector of the angls between the lines.

(*c*) The locus of a point equidistant from two given points is the perpendicular bisector of the line joining the points.

(*iv*) Circles

(*a*) *Chord Properties* :

- A straight line drawn from the centre of a circle to bisect a chord which is not a diameter is at right angles to the chord.
- The perpendicular to a chord from the centre bisects the chord (without proof).
- Equal chords are equidistant from the centre.
- Chords equidistant from the centre are equal (without proof).
- There is one and only one circle that passes through three given points not in a straight line.

(*b*) *Arc and chord properties* :

- The angle that an arc of a circle subtends at the centre is double that which it subtends at any point on the remaining part of the circle.
- Angles in the same segment of a circle are equal (without proof).
- Angle in a semi-circle is a right angle.
- If two arcs subtend equal angles at the centre, they are equal, and its converse.

- If two chords are equal, they cut off equal arcs, and its converse (without proof).
- If two chords intersect internally or externally then the product of the lengths of the segments are equal.

(c) ***Cyclic Properties :***

- Opposite angles of a cyclic quadrilateral are supplementary.
- The exterior angle of a cyclic quadrilateral is equal to the opposite interior angle (without proof).

(d) ***Tangent Properties :***

- The tangent at any point of a circle and the radius through the point are perpendicular to each other.
- If two circles touch, the point of contact lies on the straight line joining their centres.
- From any point outside a circle two tangents can be drawn and they are equal in length.
- If a chord and a tangent intersect externally, then the product of the lengths of segments of the chord is equal to the square of the length of the tangent from the point of contact to the point of intersection.
- If a line touches a circle and from the point of contact, a chord is drawn, the angles between the tangent and the chord are respectively equal to the angles in the corresponding alternate segments.

Note: Proofs of the theorems given above are to be taught unless specified otherwise.

(v) Constructions

(*a*) Construction of tangents to a circle from an external point.

(*b*) Circumscribing and inscribing a circle on a triangle and a regular hexagon.

4. Mensuration

Area and circumference of circle, Area and volume of solids – cone, sphere.

(a) ***Circle*** : Area and Circumference. Direct application problems including Inner and Outer area.

(b) ***Three-dimensional solids*****: Right circular cone and sphere** : Area (total surface and curved surface) and Volume. Direct application problems including cost, Inner and Outer volume and recasting into another solid. Combination of two solids included.

Note : Frustrum not included. Areas of sectors of circles other than quarter-circle and semi-circle not included.

5. Trigonometry

(a) ***Using Identities*** to solve/prove simple algebraic trigonometric expressions.

$\sin^2 A + \cos^2 A = 1$

$1 + \tan^2 A = \sec^2 A$

$1 + \cot^2 A = \operatorname{cosec}^2 A$, $0 \le A \le 90°$

(b) ***Trigonometric ratios of Complementary angles and direct application*** **:**

$\sin A = \cos (90° - A)$,

$\cos A = \sin (90° - A)$

$\tan A = \cot (90° - A)$,

$\cot A = \tan (90° - A)$

$\sec A = \operatorname{cosec} (90° - A)$,

$\operatorname{cosec} A = \sec (90° - A)$

(c) ***Heights and distances*** **:** Solving 2-D problems involving angles of elevation and depression using trigonometric tables.

Note : Cases involving more than two right angled triangles excluded.

6. Statistics

Statistics – Basic concepts, histograms and ogive, mean, median, mode.

(a) ***Graphical Representation*** **:** Histograms and ogives.

- Finding the mode from the histogram.
- Finding the upper quartile, lower quartile and median from the ogive.
- Calculation of inter quartile range.

(b) Computation of :

- Measures of Central Tendency : Mean, median, mode for raw and arrayed data.

  Mean*, median class and modal class for grouped data. (both continuous and discontinuous).

* Mean by all 3 methods included :

Direct : $\frac{\Sigma fx}{\Sigma f}$

Short-cut : $A+\frac{\Sigma fd}{\Sigma f}$, where $d = x - A$

Step-deviation : $A+i.\frac{\Sigma ft}{\Sigma f}$,

where $t=\frac{x-A}{i}$

7. Probability

- Random experiments
- Sample space
- Events
- Definition of probability
- Simple problems on single events (tossing one or two coins, throwing a die and selecting a student from a group)

SI units, signs, symbols and abbreviations

(1) Agreed conventions

(*a*) Units may be written in full or using the agreed symbols, but no other abbreviation may be used.

(*b*) The letter 's' is never added to symbols to indicate the plural form.

(*c*) A full stop is not written after symbols for unit unless it occurs at the end of a sentence.

(*d*) When unit symbols are combined as a quotient, *e.g.*, metre per second, it is recommended that they be written as m/s, or as ms^{-1}.

(*e*) Three decimal signs are in common international use: the full point, the mid-point and the comma. Since the full point is sometimes used for multiplication and the comma for spacing digits in large numbers, it is recommended that the mid-point be used for decimals.

2. Names and symbols

(a) In general

implies that	$\Rightarrow$	is logically equivalent to	$\Leftrightarrow$
identically equal to	$\equiv$	is approximately equal to	>>

(b) In set language

belongs to	$\in$	does not belong to	$\notin$
is equivalent to	$\leftrightarrow$	is not equivalent to	$\nleftrightarrow$
union	$\cup$	intersection	$\cap$
universal set	ξ	is contained in	$\subset$
natural (counting) numbers	N	the empty set	ϕ
integers	Z	whole numbers	W
		real numbers	R

(c) In measures

kilometre	km	metre	m
centimetre	cm	millimetre	mm
kilogram	kg	gram	g
litre	l	centilitre	cl
square kilometre	km^2	square metre	m^2
square centimetre	cm^2	hectare	ha
cubic metre	m^3	cubic centimetre	cm^3
kilometres per hour	km/h	metre per second	m/s or m s^{-1}

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