

## CHAPTER 1 STATEMENTS AND SETS

### Lesson 1 Logical Statements: Sets

Statements  
Sets  
Subsets  
Elements

### Lesson 2: Variables and Quantifiers

Variables  
Quantifiers  
Solution set  
Specifying sets

### Lesson 3 Operations on Sets and Statements

Union/ Intersection of Sets  
Venn diagrams  
Conjunction/ disjunction of statements

### Lesson 4 Conditional Statements and Converses

Conditional statements  
(Concentration on “if p then q” and “p implies q” forms)  
Converses

### Lesson 5 Negations

Negations

### Lesson 6 Complements

Venn diagrams (Union and Intersection)

### Lesson 7 Truth tables

### Lesson 8 Logical inference (proofs) Problems 1 – 18

## CHAPTER 2 ORDERED FIELDS

### Lesson 1: Axioms for Fields

Axioms of Equality  
Axioms of Addition, Multiplication, Distribution  
Axioms of Equality of Sums and Products  
Groups and Commutative Groups  
Fields

### Lesson 2: Proving Theorems Problems 1-10/ 17-22

Cancellation law of Addition  
Cancellation law of Multiplication  
Algebraic Proofs

### Lesson 3 Indirect Proof

Principle of Indirect Inference

### Lesson 4 Axioms of Order Problems 1-14, 15, 24, 27

Axioms of Comparison  
Transitive Property of Order  
Addition Property of Order  
Multiplication Property of Order  
Substitution Property of Order  
INTERVAL NOTATION

### Lesson 5 Absolute Value Problems 1-20

Absolute value equalities  
Absolute value inequalities  
Two-sided Absolute value

### Lesson 6 Subsets of $\mathbb{R}$

Number sets  
Divisibility  
Prime and Relatively Prime  
Composites  
Fundamental Theorem of Arithmetic

## CHAPTER 3    MATHEMATICAL INDUCTION- SEQUENCE AND SERIES

### Lesson 2       Sequences and Series

Recursive definition  
Nth term definition  
Expand and compute from Summation form

### Lesson 1       Mathematical Induction

Principle of Mathematical Induction

### Lesson 3       Arithmetic Progressions

Recursive definition  
Nth term definition  
Summation  
Arithmetic Means

### Lesson 4       Geometric Progressions

Recursive definition  
Nth term definition  
Summation  
Geometric Means

### Lesson 5       Binomial Theorem

Factorials  
Binomial Coefficient  
Binomial Expansion  
Pascal's Triangle

### Lesson 6       Limit of a Sequence

Convergent and Divergent sequence

Evaluating limits to infinity  
Sum, difference, product, and Quotient Rules for limits  
Coefficient Rule for limits

Lesson 7      Infinite Geometric Series

Partial Sums  
Sum of an infinite geometric series

**CHAPTER 4      ALGEBRA OF VECTORS**

Lesson 1:      Ordered Pairs and Points

Cartesian product  
Abscissa and Ordinate  
Equality of ordered pairs  
Specifying ordered pairs by roster

Lesson 2      Ordered Pairs, Displacements, and Arrows

Displacement  
Standard Position  
Sketching vectors  
Sketching and determining the vector between two vectors' endpoints

Lesson 3      Vector Addition

Vector addition graphically  
Vector addition arithmetically  
Vector addition properties (commutative, associative, identity, and Inverse)  
Vector subtraction graphically (adding the inverse)  
Vector subtraction arithmetically

Lesson 4      The Norm of vector

Triangle inequality  
Norm of a vector  
Resultant of vectors

Lesson 5      Multiplication of a vector by a Scalar

Multiplication by a scalar  
Non-zero and Zero vectors  
Same and opposite direction  
Parallel and non-parallel vectors  
Unit vectors

Lesson 6      Inner Product

Inner product  
Perpendicular vectors (verifying and finding missing values)

Lesson 7 Relationships among Parallel and Perpendicular Vectors

Lesson 8 Perpendicular Components of Vectors (OPTIONAL IF CHAPTER 5 IS OMITTED)

Linear combinations  
Perpendicular components of a given vector

**CHAPTER 5 PLANE ANALYTIC GEOMETRY OF POINTS AND LINES**

Lesson 1 Points in the Plane

Distance formula  
Triangular inequality

Lesson 2 Lines in the Plane

Vector form of a linear equation  
Vector form of a ray

Lesson 3 Coincident and Parallel Lines

Direction vector for a line  
Coincident and parallel lines using vector form

Lesson 4 The Line through Two points

Vector equation through two points  
Vector equation through a point parallel to another vector  
Vector equation of a Ray  
Coinciding lines  
Collinear points

Lesson 5 Line Segments

Length of a segment  
Equation of a segment

Lesson 7 Equation of a line

Normal vectors to a line  
 $Ax + By = C$  form using a normal vector  
 $Ax + By = C$  form using a vector equation  
Perpendicular vector equations

Lesson 8      Distance Between a Point and Line

Distance between a point and a line  
Distance between two lines

Lesson 9      Intersection of Lines

Intersection of lines using the inner product  
Intersection of lines using determinants

**CHAPTER 6      FUNCTIONS**

Lesson A      Radical and Rational Functions

Domain and Range of Radical functions and Rational functions  
Graphs Radical functions and Rational functions  
Asymptotes using degrees and leading coefficients (horizontal, vertical, slant)

Lesson 5      Polynomials

Definition of a polynomial  
Degree, leading coefficient, leading term, constant term  
Polynomial name by degree and number of terms  
Equality of polynomials  
Synthetic substitution

Lesson 6      The Arithmetic Of Polynomials

Addition, subtraction, and multiplication  
Long division  
Synthetic division  
Remainder Theorem

Lesson 7      Factor theorem

Factor theorem  
Multiplicity of a factor

Lesson 8      Rational Roots

Rational Root Theorem (possible rational roots)  
Proof of irrationality of a number

Lesson 9      Bounds for Real Roots; Descartes' Rule

Upper bound for real roots  
Lower bound for real roots  
Descartes' rule of signs (possible number of real roots)

**CHAPTER 7      THE FIELD OF COMPLEX NUMBERS**

Lesson 1      Reducibility over a Field

Reducible polynomials  
Irreducible polynomials  
Prime polynomials  
Algebraically complete  
FACTORING PATTERNS and USE OF DISCRIMINANT FOR FACTORING

Lesson 2      Addition of Complex Numbers

Standard form of a complex number  
Real part of a complex number  
Imaginary part of a complex number  
Complex numbers as points and as vectors  
Absolute value (modulus) of a complex number  
Addition and subtraction of a complex number (arithmetically and graphically)

Lesson 3      Multiplication of Complex Numbers

Conjugate of a complex number  
Multiplication of complex numbers  
Reciprocals of complex numbers  
Rationalizing a fraction of complex numbers

Lesson 4      Square Roots and Complex Numbers

Expressions involving square roots of negatives  
(OMIT: square roots of imaginary numbers)

Lesson 5      Fundamental Theorem of Algebra

Factoring polynomials over the field of complex numbers

Lesson 6      Relationships Among Roots and Coefficients

Formulas connecting roots and coefficients  
Polynomial equations from roots  
Missing roots and coefficients for given polynomial equations

Lesson 7      Polynomials with Real Coefficients

Imaginary roots as conjugates  
Polynomial equations from roots  
Missing roots and coefficients for given polynomial equations

**CHAPTER 8      GRAPHS OF POLYNOMIAL FUNCTIONS**

Lesson 1      Plotting Points in Curve Sketching

Plot points to sketch curves (use graphing calculator to verify graphs)

Lesson 2      Limits of Functions; Continuity

Limit of a function  
Continuous at C (3 steps to be continuous at C)  
Discontinuous at C

Lesson 3      The Location Principle

The Location Principle  
Descartes Rule of Sign (revisited)

Lesson 4      Tangents to a Curve

Slopes of tangent lines using limits  
Equations of tangent lines

Lesson 6      Derivatives of Polynomials



Derivatives of Polynomials (first and second)  
Slope using derivatives  
Equations of tangent lines

Lesson 7      Using Derivatives in Graphing

The leading Coefficient Test (not in textbook, need to add this to lesson)  
Critical points  
Maximum and Minimum Points by derivatives  
Inflection points by derivatives  
Graphs of polynomials without calculators (i.e. plotting max, min, inflection points, x and y intercepts)

Lesson 8      Application of Maxima and Minima

Application of derivatives to word problems

**CHAPTER 9      EXPONENTIAL AND LOGARITHMIC FUNCTIONS**

Lesson 1      Rational Exponents      (NO PROOFS)

Properties of exponents

Lesson 4      Exponential Functions      (Asymptotes are not covered in the book)

Graphs of Exponential functions  
Asymptotes

Lesson 6      Composition of Functions

Mapping  
One -to- one  
Composition of functions  
Domain of the composition

Lesson 7      Inverse Functions      Problems 1- 24

Inverse of a function defined by ordered pairs  
Inverse of a function defined by an equation

Lesson 8      Inverse of an Exponential Function

Definition of a logarithm  
Logarithmic and exponential form of an equation  
Logarithmic function as the inverse of an exponential function  
Graph of a logarithmic function  
Laws of logarithms

Lesson 9      Values for Log x

Logarithmic equations  
Exponential equations using logs

Lesson 10      Values of log (base b) x

Change of Base formula (ONLY)

**CHAPTER 10    THE CIRCULAR FUNCTIONS AND TRIGONOMETRY**

Lesson 1      The Unit Circle

Ordered pairs on the unit circle  
Distance from x axis to points along unit circle

Lesson 2      The Sine and Cosine Functions

Sin/Cos of quadrantal angles  
Sin/Cos of 30-45-60  
Sign of Sin/Cos by quadrant  
Sin/Cos using reference angles  
Sin/Cos Pythagorean Identity

Lesson 3      Graphs of Sine and Cosine

Sin/ Cos Period  
Graph of Sin/Cos functions

Lesson 4      Amplitude and Period

Amplitude of  $y = A \sin (BX)$  and  $y = A \cos (Bx)$

Period of  $y = A \sin (BX)$  and  $y = A \cos (Bx)$

Graph of  $y = A \sin (BX)$  and  $y = A \cos (Bx)$

Lesson 5      Phase Shift

Vertical and horizontal shifts

Graph of  $y = A \sin (B (x-C)) +D$  and  $y = A \cos (B (x-C)) +D$

Lesson 6      Other Circular Functions

Other functions defined in terms of Sin and Cos

Graphs of other Trig Functions

Lesson 7      Identities

Pythagorean Identities

Verification of Identities

Lesson 9      The Trigonometric Functions

Values of functions based on terminal side ordered pairs

Values of functions based on quadrants and other function values

**CHAPTER 11      PROPERTIES OF CIRCULAR AND TRIGONOMETRIC FUNCTIONS**

Lesson 1      Cosine of the Sum of two Numbers

$\cos (A \pm B)$

Reduction formulas involving 90, 180, 270,  $\pi/2$ ,  $\pi$ , and  $3\pi/2$

Lesson 2      Additional Sum, Difference, and Reduction Formulas

$\sin (A \pm B)$

$\tan (A \pm B)$

Reduction formulas involving 90, 180, 270,  $\pi/2$ ,  $\pi$ , and  $3\pi/2$

Lesson 4      Double and Half Angle Identities

$\sin, \cos, \tan (2a)$

$\sin, \cos, \tan (a/2)$

Lesson 5      Inverse Values

“Arc” notation for inverses  
Inverse values as sets of elements  
Two trig ratio problems (i.e.  $\sin(\arctan 1)$ )

Lesson 6      Inverse Circular Functions

Inverse trig function Domains and Ranges  
Graphs of inverse functions  
Evaluating for the principal value of an inverse function

Lesson 7      Open Sentences and Circular Functions

Basic trig equations  
Equations using identities  
Equations using factoring

Lesson 8      Converting Sums and Products

Sum formulas for sin and cos  
Product formulas for sin and cos