



## Lahore University of Management Sciences

### MATH 100 – Pre Calculus Section-I & Section II

Fall 2023-2024

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Course URL (if any)	lms.lums.edu.pk

#### COURSE TEACHING METHODOLOGY

The course is divided into three modules; each module is of around six weeks. At least one quiz will be taken every two weeks and a comprehensive graded midterm/module exam based on the current and previous module's content will be taken at the end of each module. There will be weekly tutorials/recitations covering the provided exercise sheets, emphasizing upon geometrical interpretation of the concerned concepts. An interplay between algebra and geometry is one of the key learning objectives. We plan to emphasize this idea throughout this course to make the course more interesting and accessible.

Course Basics				
Credit Hours	3			
Lecture(s)	Nbr of Lec(s) Per Week	2	Duration	75min
Recitation/Lab (per week)	Nbr of Lec(s) Per Week		Duration	
Tutorial (per week)	Nbr of Lec(s) Per week		Duration	

Course Distribution	
Core	
Elective	
Open for Student Category	All students
Close for Student Category	None

#### COURSE DESCRIPTION

This course is only for students who have not studied mathematics in A-levels, FSc, or equivalent. This course covers the essential concepts required so that the students can go on to take calculus afterward. It aims at completing the formal study of the functions; focusing on modeling, problem solving, data analysis, trigonometric and circular functions and their inverses, polar coordinates, complex numbers, conics, and quadratic relations, along with sequences and series. The intent is to present and explore concepts from symbolic, graphical, and numerical perspectives.

COURSE PREREQUISITE(S)	
	N/A
COURSE Anti-PREREQUISITE(S)	
	A-level/FSc Mathematics or equivalent



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COURSE OBJECTIVES	
	This course aims at developing a solid mathematical basis for incoming university students so that they are able to take higher mathematical courses. It addresses the fundamental of mathematics for application in science, engineering and commerce; while striking a balance between theory and application.

Grading Breakup and Policy
Assignment(s): 10% ( <i>webwork</i> ) Module/Midterm Exam(s): (One for each module) (20% each, $15 \times 2 = 30$ %) Quizzes/Test: 20% ( unannounced Quizzes) Final Examination: 40%

Examination Detail	
Module Exam(s)	Yes/No: Yes Combine/Separate: Combine Duration: TBA Preferred Date: TBA Exam Specifications: No notes/No books/No calculators
Final Exam	Yes/No: Yes Combine Separate: Combine Duration: TBA Exam Specifications: No notes/No books/No calculators

COURSE OVERVIEW			
Week/ Lecture/ Module	Topics	Recom mended Reading s	Objectives/ Application
<b>Module I</b>			
•	<b>SETTING THE SCENE:</b> <b>Number systems:</b> Integers, Rational and Irrational, Real, and Complex numbers. Absolute value, Exponent and Radicals, Algebraic Expressions, Rational Expressions, the Coordinate Plane. <b>Graph:</b> Introduction to Graphing Equations, The Distance and Midpoint Formulas, Intercepts; Symmetry, Lines and Circle, Slope intercepts formula, Solving Equations and Inequalities Graphically.	1.1-1.6, 1.8- 1.11	This module begins by looking at the different kinds of numbers that fall on the real number line, decimal expansions and approximations, then continues with an exploration of manipulation of equations and inequalities, and the use of the Cartesian plane.
•	<b>THE FUNDAMENTAL CONCEPT:</b> <b>Functions:</b> Functions as rules, with domain and range; composite and inverse function; properties of function; Graphs of Functions; Some basic functions	2.1-2.8	An introduction to the notion of a function which captures precisely the ways in which different quantities or measurements are linked together. Creating new functions using composition and inversion and looking at how to move backwards and forwards between quantities algebraically, as well as visually, with transformations in the xy-plane.
•	<b>IMPORTANT FUNCTIONS:</b> <b>Linear and Quadratic Functions:</b> linear function, properties and models, quadratic function, properties and models, quadratic equation, complex numbers, solving in equalities	3.1	Determining the key features of the linear and quadratic functions. Graph of Linear Functions, Using Average Rate of Change to identify Linear Functions, Determine whether a Linear Function is Increasing,



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			Decreasing, or Constant, learning to solve inequalities involving quadratic functions.
•	<b>ALGEBRAIC FUNCTIONS:</b> <b>Polynomial and Rational Functions:</b> Polynomial Functions and their models, Factors and Zeros of Polynomials Rational Functions and their graphs, Other Algebraic Functions,Complex Roots of Polynomials, Fundamental Theorem of Algebra, remainder theorem, factor theorem, Polynomial and rational inequalities.	3.2-3.7	Here we covers quadratic, cubic and general power and polynomial functions. Modeling the polynomial functions to find of the extrema of the functions. Understanding the concept of rational functions. Finding the characteristics such as asymptotes of the rational function and their graphs. Learning to use remainder theorem, facor theorem, fundamental theorem of algebra and the conjugate roots theorem.
	<b>Module I exam</b>		
<b>Module II</b>			
•	<b>Exponential and Logarithmic Functions:</b> Exponential functions, the natural exponential function, logarithmic functions and their properties, laws of logarithms, logarithmic and exponential equations, modeling with exponential functions, logarithmic Scales	4.1-4.7	Defining the exponential functions and how they help in explaining a lot of real life phenomena especially those involving population, growth and decay Understanding the laws of logarithmic function with change of base and application of logarithmic functions.
•	<b>TRIGONOMETRY:</b> <b>Trigonometric functions, right triangle trigonometry and unit circle:</b> Angles and their measure; trigonometric functions via unit circle; right triangle trigonometry; basic properties and graphs of trigonometric functions, trigonometric functions of angles	5.1-5.5 6.2-6.4	Developing an understanding of trigonometric functions, their basic properties and graphical interpretation
•	<b>Analytic Trigonometry and Application:</b> trigonometric equations; trigonometric identities; sum and difference formulas; double-angle and half-angle formulas; product-to-sum and sum-to-product formulas, law of sine, law of cosine.	6.5,6.6, 7.1-7.5.	Learning the basic trigonometric identities. Using sum, difference, half angle and double angle identities. Understanding graph of trigonometric functions and their inverses. Learning right angled and non-right angled geometry Using laws of sine and cosine.
	<b>Module II exam</b>		



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Module III			
•	<b>Polar Coordinates:</b> Polar Coordinates, Graphs of Polar Equations, Polar Form of Complex Numbers, De Moivre's theorem, Plane Curves and Parametric Equations.  <b>Vectors:</b> Vectors, Position vector, Adding and Subtracting Vectors Algebraically, Scalar Multiple of vectors, Magnitude of a Vector, direction of vector, Unit Vector, Dot and cross Product of Vectors, Equations of Lines and Planes.	8.1-8.4, 9.1,9.2,9.5,9.6.	Converting polar coordinates to rectangular coordinates and vice versa, Plotting Points in the Complex Plane, Converting a Complex Number between Rectangular Form and Polar Form, Use of De Moivre's Theorem,  Understanding Vectors and vector arithmetics. Developing an insight into application of vectors.
•	<b>Analytic Geometry:</b> Conics: Parabola, Ellipse, Hyperbola, General Form of Conics; defining center, foci, vertices, directrix and Rotation of axis  <b>Sequences and Series:</b> Sequences and Summation Notation, Arithmetic Sequences, Geometric Sequences, Mathematical Induction, The Binomial Theorem.	11.1-11.5  12.1-12.3, 12.5,12.6	Recognizing conic sections and their geometric properties. Differentiating between conic sections: ellipse, hyperbola, parabola, using the standard and the general form of the equations, understanding graphs of conic sections.  Learning to write First Several Terms of a Sequence defined by a Recursive Formula, Finding the Sum of a Sequence. Finding a Formula for an Arithmetic and Geometric Sequences. Application of binomial theorem and mathematical induction
•	<b>FINAL EXAM</b>		

### Textbook(s)/Supplementary Readings

#### Textbook:

- Precalculus, Mathematics for Calculus by James Stewart, Lothar Redlin, Saleem Watson. (7<sup>th</sup> edition)

#### Online Notes:

- <https://openstax.org/details/books/prec calculus>
- <https://math.libretexts.org/Special:Search?gid=&fpid=230&fpth=&query=prec calculus&type=wiki>.
- <https://tutorial.math.lamar.edu/Classes/Alg/Alg.aspx>

#### Supplementary Readings:

- Precalculus: Enhanced with Graphing Utilities, 9<sup>th</sup> edition. By M. Sullivan & M. Sullivan, III.
- Precalculus with unit-circle trigonometry by David Cohen.

#### Supplemental Websites:

- Khan Academy is a free resource. It may require you to set up an account.
- Purple Math has many lessons for free. However, Purple Math Plus requires you to enroll in monthly or yearly plan.
- S.O.S. Mathematics is a free resource.
- West Texas A & M University Virtual Math Lab is a free online tutorial.