

**LAGUARDIA COMMUNITY COLLEGE
CITY UNIVERSITY OF NEW YORK
MATHEMATICS, ENGINEERING & COMPUTER SCIENCE DEPARTMENT**

**MAT 200: PRECALCULUS
4 credits, 5 hours
4 classroom hours, 1 lab hour**

Catalog Description

4 credits, 5 hours (4 classroom hours, 1 lab hour)

Prerequisite: MAT 115 or MAT117

This course is intended as a preparation for the study of calculus. Functions and their graphs are analyzed theoretically within a framework that emphasizes their roles in applied settings. Particular attention will be paid to polynomial, exponential, logarithmic, and trigonometric models. Use of graphing utilities (computer algebra systems, scientific/non-graphing calculators, etc.) as analytical tools will be emphasized; the online learning platform MyMathLab will be used.

Instructional Objectives

During the semester, the instructor will aim to:

- 1.) Reinforce and explore functional patterns as naturally occurring phenomena.
- 2.) Introduce students to verbal, numerical, graphical, and symbolic representations of functions.
- 3.) Enable students to critically analyze linear, power, and exponential models both algebraically and graphically, enhancing students' inquiry and problem solving skills.
- 4.) Familiarize students' rigid and non-rigid transformations both graphically and analytically.
- 5.) Introduce and explore the concept of inverse function and relate inverse functions – graphically and algebraically – to the corresponding original functions.
- 6.) Introduce students to logarithmic functions as inverses of the exponential functions and familiarize them with techniques for solving logarithmic equations.
- 7.) Introduce the trigonometric functions and their inverses, present a comprehensive treatment (including graphs) of the sine and cosine functions, and explore elementary applications.
- 8.) Facilitate the students' use of graphing utilities as analytical tools.
- 9.) Reinforce students' written communication skills through the completion of writing assignments.
- 10.) Introduce students to a Computer Algebra System (CAS) as a digital tool for building and analyzing various mathematical models, in order to reinforce students' inquiry and problem solving skills (Digital Ability).

Textbook: **PRECALCULUS: Concepts Through Functions. A Unit Circle Approach to Trigonometry** by Sullivan&Sullivan. Second Custom Edition for LaGuardia Community College, 2014 (ISBN-13: 9781269954167). Pearson Education Inc. Published by Pearson Prentice Hall, Inc.

Evaluation

1) Tests (and instructor's quizzes)	45%
2) Maple Lab, HW Assignments, and Project	20%
3) Final Examination	35%

Suggested Plan of Lessons

Weeks/Lessons	Sections	Pg.	Topic(s)	Suggested Homework Exercises
Week 1 Lessons 1 – 5	F.1–F.3, A.3, A.4	2, A.22	Brief review of basics	Instructor's choice
	F.4	34	Circles	Pg. 38: #23-37 odd, 43, 47,51
	1.1	43	Functions	Pg. 53: # 1 – 14, 16, 19, 30, 33, 34, 37, 41, 51, 55, 59, 60, 61 – 85 (odd), 95, 104, 106, 107
	1.2	56	Graph of a function	Pg. 61: # 3 – 6, 9, 11, 13, 16, 23 – 27 (odd), 33, 37, 46
	1.3	66	Properties of Functions	Pg. 75 # 6 – 9, 11 – 25 (odd), 39 – 51 (odd), 61 – 69 (odd)
Lab (short introductory session about Maple).				
Week 2 Lessons 6 – 10	1.4	78	Library of Functions. Piece-wise defined functions	Pg. 85: # 22, 25, 28, 31, 33, 35, 41, 43, 47
	1.5	89	Graphing Techniques: Transformations	Pg. 97: # 7, 9, 28, 29, 35 – 57 (odd), 93
	2.1	119	Properties of Linear Functions. Models.	Pg. 126: #7, 18, 25, 27, 37, 41, 43, 45, 51, 53, 61
Lab.				
Week 3 Lessons 11 – 15	2.3	137	Quadratic Functions	Pg. 145: # 1 – 3, 8, 11, 15, 17, 25, 28, 31, 43, 47, 55, 102, 105
	2.4	148	Properties of Quadratic Functions	Pg. 157: # 5 - 7, 12, 35, 39, 47, 61, 63, 71, 81, 83, 89, 95
	2.5	160	Inequalities Involving Quadratic Functions	Pg. 163: # 5 – 19 (odd), 25, 33, 35, 37
Lab. In-class Quiz is recommended.				
Week 4 Lessons 16 – 20	2.6	164	Quadratic Models	Pg. 171: #3, 5, 7, 10. It is suggested to use problems similar to #27 – 30 for the Lab sessions using Maple and HW/Lab assignments
	2.8	178	Equations & Inequalities Involving Absolute Value Functions	Pg. 181: # 13 – 21 (odd), 29, 47 – 57 (odd), 67, 75
	3.1	192	Polynomial Functions	Pg. 207: # 6, 23, 27, 37, 41, 49, 51, 61, 71 – 77 (odd), 114, 124
	3.4	232	Properties of Rational Functions. Asymptotes.	Pg. 240: # 13 – 23 (odd), 27, 28, 29, 43, 49, 50
Review for Exam #1				
Week 5 Lessons 21 - 25	Exam #1			
	4.1	274	Composite functions	Pg. 279: # 7(a, d), 9(a), 11, 16, 21, 25, 27, 35, 41, 47, 50, 53, 56
	4.2	282	One-to-one functions. Inverse Functions	Pg. 290: # 12, 27, 29, 33, 41, 45, 51, 59, 65, 67, 77, 92, 98
Lab.				
Week 6 Lessons 26 - 30	4.3	294	Exponential functions.	Pg. 305: # 25, 29, 33, 41, 43, 53, 54, 57, 61- 81 (odd), 91, 99, 104, 105, 107, 109, 120
	4.4	311	Logarithmic functions	Pg. 320: # 4, 9, 15, 17, 21, 25 – 37, 59, 72, 89 – 101 odd, 119, 120, 123, 133
	4.5	324	Properties of logarithms	Pg. 331: # 2, 3, 7, 9, 12, 13 – 29 (odd), 37 – 51(odd), 57 – 63 (odd), 111
	4.6	333	Exponential and logarithmic equations	Pg. 337: # 5 – 43 odd, 49, 53, 87
	Lab.			

Week 7 Lessons 31 – 35	4.7	339	Financial models. Compound Interest.	Pg. 346: # 9, 13, 21, 31, 35, 39, 41, 48, 51
	4.8	349	Exponential Growth and Decay models	Pg. 356: # 1, 2, 3, 5, 7
	Review for Exam #2			
	Lab.			
Week 8 Lessons 36 – 40	Exam #2			
	5.1	376	Angles and their Measure	Pg. 385: # 11, 17, 19, 20, 37, 39, 45, 47, 57, 71, 73, 79, 91, 99, 107
	5.2	390	Trig. Functions (Unit Circle)	Pg. 402: # 13, 14, 21, 31, 35, 41, 47, 49, 51, 77, 83, 85, 89, 121, 123
	5.2	390	Trigonometric functions. Continued.	Pg. 402: # 77, 83, 85, 89, 121, 123
	5.3	407	Properties of Trigonometric Functions.	Pg. 417: # 5, 17, 19, 20, 25, 27, 35, 43, 59, 60, 63, 67, 69, 77, 80, 81, 83, 86
Week 9 Lessons 41 – 45	5.4	420	Graphs of the Sine and Cosine functions	Pg. 431: #9, 11 – 21 odd, 35 – 65 odd, 77, 79, 86, 87
	5.5	435	Graphs of other circular (trig.) functions.	Pg. 441: #5, 15, 16, 17, 27, 34, 41, 42
	5.6	443	Phase Shift; Sinusoidal curve fitting.	Pg. 452: # 3 – 11 (odd), 27
	6.1	464	Inverse Trigonometric Functions - I	Pg. 473: # 5, 6, 7, 13 – 23 odd, 37, 41, 45, 61, 65
	Review for Exam #3			
Week 10 Lessons 46 - 50	Exam #3			
	6.2	476	Inverse Trigonometric Functions - II	Pg. 480: # 9 – 23 odd, 38, 47, 57
	6.3	482	Trigonometric equations	Pg. 487: # 7 – 19 odd, 25, 29, 31, 35, 41, 43, 45, 53, 57, 59, 60, 69 – 75 odd, 93, 95
	6.4	491	Trigonometric identities	Pg. 496: # 3, 10, 12, 13, 19 – 33 odd, 49, 51, 72.
	6.5	499	Sum and difference formulas	Pg. 508: # 9, 25, 27, 29, 39, 47 – 57 odd, 65, 66, 73
	Lab. Final project is distributed. Due in 2 weeks.			
Week 11 Lessons 51 – 55	6.6	511	Double and half angle formulas	Pg. 518: # 7, 11, 19, 21, 41, 43, 47, 56, 99
	7.1	532	Right Triangle Trigonometry. Applications	Pg. 539: # 9, 11, 15, 19 – 29 odd, 33, 41, 49, 54, 69
	7.2	544	The Law of Sines	Pg. 551: # 5, 9, 16, 17, 19, 25, 41, 47
	Lab. Work on the Final Project.			
Week 12	7.2 continue	545	The Law of Sines. Continue.	
	7.3	555	The Law of Cosines.	Pg. 558: # 9, 17, 19, 33
	9.2 and 9.3	661	Selected topics – Conics, Parabola, Ellipse.	Pg. 667: #7 – 27 odd + Instructor's choice. Pg. 678: # 11 – 31 odd + Instructor's choice
	Review for the Departmental Final Exam			
Departmental Final Examination (cumulative).				

Laboratory attendance is mandatory

All students must submit at least six HW/Lab assignments and a final project. Being a part of the Flexible Core, **MAT200 is selected for Inquiry and Problem Solving / Digital Communication Ability Project Depositing to ePortfolio for Assessment.**

Suggested Lab Hour Topics (See Appendix C for sample Lab lessons and assignments)

- Domain and Range
- Functions and their properties, Rate of Change
- Transformations of Graphs
- Polynomial Functions: Curve Fitting, Modeling
- Inverse Functions
- Exponential and Logarithmic Functions
- Trigonometric Functions

Note: Problems and Projects at the end of every chapter are appropriate for lab assignments.

Remarks About Evaluation

- 1.) Several homework/laboratory writing assignments will be collected during the semester. Each assignment should be submitted by its due date. Assignments turned in late may not receive full credit. In addition, quizzes on homework/lab material may be given at various times during the term.
- 2.) Each of the three examinations will be given in class.
- 3.) The project should be submitted by its due date (sometime during the week before the Final exam week). Papers turned in late may not receive full credit. The project should provide a more complete analysis of material covered in class; it should contain both algebraic and graphical analysis where appropriate.

General Comments

- 1.) The specific topics listed in the suggested lesson plan and the principles of evaluation listed above are both subject to minor modification by the instructor.
- 2.) The instructor will assign homework relevant to the topics in the course. Each student is strongly encouraged to complete these assignments to the best of his or her ability consistently throughout the semester. Generally speaking, the student that follows this recommendation will maximize his or her understanding of the subject matter and achieve optimal performance on examinations.

Performance Objectives

At the end of the semester, the student will be able to:

- 1) Interpret functional patterns and create functions modeling natural phenomena.
- 2) Compare and contrast functional representations and inter-convert such representations.
- 3) Describe the algebraic/graphical solutions of real-world problems using linear, power, and exponential functions.
- 4) Explain the use of rigid and non-rigid transformations in problem solving.
- 5) Compute inverse functions and use their properties to obtain more precise information about the original functions.
- 6) Solve exponential and logarithmic equations with emphasis on real-world application (e.g., population growth and radioactive decay).
- 7) Solve problems involving the trigonometric functions and their inverses in both
- 8) theoretical and applied settings; in particular graph the sine and cosine functions.
- 9) Solving analytical problems using graphing utilities.
- 10) Complete written assignments on various topics in Pre-Calculus.
- 11) Analyze mathematical models using a Computer Algebra System highlighting inquiry and problem solving skills (Digital Ability).