

# Departmental Syllabus for MAT 194 Pre-calculus Spring 2019

**Course Description:** This course is designed to prepare you for success in the study of calculus. Using graphical, numerical, and symbolic representations, you will investigate the basic properties of many elementary functions, including: polynomial, rational, exponential, logarithmic, and trigonometric. These functions and their applications will be the core focus of the course. You will engage in applied problem solving in collaborative group settings using graphing technologies. A second but equally important aim of this course is for you to refresh and retain the algebra skills necessary to succeed in your next math course. There will be weekly assignments and quizzes that will address these competencies.

## **Learning Outcomes:**

- Students will be able to use and understand the usage of mathematical notation
- Students will be able to select an appropriate mathematical model for a given real world problem
- Students will be able to do hand calculations accurately and appropriately
- Students will be able to do calculations with the aid of appropriate hardware and/or software

**Course Supervisor:** Dr. Nicole Fonger, 103B Carnegie, nfonger@syr.edu. Please inform your instructor of any problems you have with this course. Problems not satisfactorily resolved with your instructor should be brought to the attention of the Course Supervisor.

## **Required Materials:**

- (1) Textbook: Connally, E., Hughes-Hallett, D., Gleason, A. M., et al. (2015). *Functions modeling change: A preparation for calculus* (5th ed.). Hoboken, NJ: John Wiley & Sons, Inc. Also available as a custom edition at the SU bookstore.
- (2) WileyPlus access code. This will be included with a new copy of the textbook purchased at the SU Bookstore. Other options are available for purchase separately. Note: the WileyPlus access code includes an e-Book version of the textbook. You need not have both a hard copy of the text and an electronic version. However, the WileyPlus code is required.
- (3) TI-84, TI-83+, or TI-84+ CE graphing calculator. This may be purchased at a variety of local stores, including the Syracuse University Bookstore; you may also be able to borrow a calculator from the library for short periods of time. The calculator may be used on all homework, tests and the final exam. You should bring your calculator with you to class and to recitation. The use of a symbolic calculator (such as the TI-89 or the TI-Nspire with CAS) will not be allowed on quizzes or exams.

**Prerequisites for Course:** Students should be competent in the use of high school level algebra. Students should have successfully completed a unit on trigonometry at the high school or college level. A student cannot receive credit for MAT 194 after receiving a grade of C or better in any calculus course. Students that have low scores on the Calculus Readiness Exam are discouraged from taking MAT 194. **Students MUST earn a grade of C- or better in MAT 194 in order to meet the prerequisites for taking MAT 295 Calculus I.**

### Student Experience

How you take this course – the depth of engagement, and nature of effort – is largely your choice. Make this choice consciously in light of your academic goals.

#### **Syracuse University, College of Arts and Sciences, Mission**

*“Preparedness:* The College of Arts and Sciences at Syracuse University provides its students with a foundation of skills and knowledge that can be applied to many academic pursuits and career paths. Employers and graduate schools value one's ability to solve problems, adapt to change, collaborate with others, and work across disciplines—all basic tenets of a liberal arts that prepare students not only for job placement, but for success and for life.”

For the complete Mission of the College see <http://thecollege.syr.edu/overview.html>

**Class Preparation:** You are expected to read the appropriate section of the text *prior* to the class in which that material is discussed. After the class presentation, you should re-read the material and work through all of the assigned problems.

The *only* way to learn mathematics is to *do* mathematics.

- You should work out and carefully write up all of the assigned exercises. A small portion of each lecture and most of recitation will be devoted to discussing these problems and others. You must fully complete each problem, plus any additional problems that you need to further your own understanding of the material. Most chapters in your textbook have a "*Skills Refresher*" section that provides help with basic algebra skills.
- You will be assigned to a homework group in your recitation. You should work with the members of your homework group to assure that you can do and understand all of the assigned problems. Most students find it beneficial to study for the tests with the members of their homework group.
- Ask questions. If something is not completely clear, ask about it in lecture, in recitation or at the Math Clinic in Carnegie 102 as soon as possible. Don't hesitate to bring questions to your course instructor or recitation instructor during office hours.
- Stay caught up. Math concepts build on each other cumulatively and you need to stay on top of the material at every stage. If you are having difficulty, don't expect that the problem will take care of itself and disappear later. Contact your course instructor or your recitation instructor immediately and discuss the problem.

## Assessment

**Homework:** Homework assignments for the entire semester are listed on the schedule at the end of this syllabus. Some assignments may be given via WileyPlus. Some assignments will be given as Group Homework. Your recitation leader will provide details on homework policies.

**Quizzes:** There will be occasional quizzes given during recitation or class throughout the semester. These will include chapter quizzes and algebra quizzes. Dates will be announced throughout the semester.

**Examinations:** There will be three examinations given during class. There will be **NO MAKE-UP EXAMS.\***

Tentative Exam Dates: Monday February 11, Friday March 8, Friday April 26 <sup>a</sup>

(<sup>a</sup>to be adjusted for UC section)

**\*No make-up quizzes or exams will be allowed, even in the case of an emergency.**

A missed quiz or examination counts as a zero unless the student presents a valid excuse from a physician or his or her dean's office. With the written excuse, your score on the relevant portion of the final exam will be used to replace the missed quiz or exam grade.

**Final Examination:** Your final examination will take place during a two-hour block on Monday, May 6, 2019. The exact time and location of your final exam will be posted on your MySlice account later in the semester. You are required to take the final examination during the appointed examination block. **DO NOT MAKE PLANS TO LEAVE CAMPUS BEFORE Monday May 6, 2019.**

**Class Attendance and Participation:** You are expected to attend and participate in class. This course is taught using lecture, small groups, and class discussion. Your success will be limited without full attendance and participation. Your instructor and recitation leader will provide details and policies.

### Syracuse University Deadlines for Spring 2019

*First Day of Classes* – Monday, January 14, 2019

*Add Class Deadline* – Tuesday, January 22, 2019

*Pass/Fail or Audit* – Monday, January 28, 2019

*Academic/Financial Drop Deadline* – Monday, February 4, 2019

*Early-Semester Progress Reports* – Monday, January 28 – Friday February 1, 2019

*Mid-Term* – Tuesday, March 5, 2019

*Spring Break No Classes* – Sunday, March 10 – Sunday, March 17, 2019

*Mid-Semester Progress Reports* – Wednesday, March 6 – Wednesday, March 20, 2019

*Withdrawal Deadline* – Tuesday, April 16, 2019

*Last Day of Classes* – Tuesday, April 30, 2019

**Grading:** Your final grade in this course will be based on your performance on homework, attendance and participation, quizzes, exams, and the final exam (which is cumulative). The relative weight assigned to each is designated below:

Exams (3 at 15% each)	45%
Final Exam	25%
Homework, Attendance, Participation	10%
Chapter Quizzes	10%
Algebraic Skill and Fluency Quizzes	10%

Your final course grade will be assigned based on the following percentages:

Percent Score	Letter Grade
93 - 100	A
90 - 92	A-
87 - 89	B+
83 - 86	B
80 - 82	B-
77 - 79	C+
73 - 76	C
70 - 72	C-
60 - 69	D
0 - 59	F

### **Resources and Support**

**Math Clinic:** Your instructor and recitation leader will be available regularly during each of her respective office hours. You can also seek assistance at the Math Clinic in Carnegie Room 102. The Clinic hours are posted: (a) outside the clinic (Carnegie 102), (b) outside the Math Department Office (215 Carnegie), and (c) on the department webpage (<http://math.syr.edu/undergraduate/math-help.html>). For University College Students, see the website for additional clinic hours.

**CLASS Tutoring:** Participate in CLASS Tutoring for FREE Group Tutoring Sessions. Learn together, get individualized support, and earn extra credit. Actively Participate in 5 sessions, earn 1 percentage point toward your overall grade. Attend 10 sessions, earn 2%. Attend 20 sessions, earn 3% (max).

*Note:* See your Course Blackboard Site for additional resources intended to support your success in this course.

## Policies and Statements

**Students with disabilities.** If you believe that you need academic adjustments (accommodations) for a disability, please contact the Office of Disability Services (ODS), <http://disabilityservices.syr.edu>, located in Room 309 of 804 University Avenue, or call (315) 443-4498 or TDD: (315) 443-1371 for an appointment to discuss your needs and the process for requesting academic adjustments. ODS is responsible for coordinating disability-related academic adjustments and will issue students with documented Disabilities Accommodation Authorization Letters, as appropriate. Since academic adjustments may require early planning and generally are not provided retroactively, please contact ODS as soon as possible.

**Academic Integrity:** Syracuse University's Academic Integrity Policy reflects the high value that we, as a university community, place on honesty in academic work. The policy defines our expectations for academic honesty and holds students accountable for the integrity of all work they submit. Students should understand that it is their responsibility to learn about course-specific expectations, as well as about university-wide academic integrity expectations. The policy governs appropriate citation and use of sources, the integrity of work submitted in exams and assignments, and the veracity of signatures on attendance sheets and other verification of participation in class activities. The policy also prohibits students from submitting the same work in more than one class without receiving written authorization in advance from both instructors. Under the policy, students found in violation are subject to grade sanctions determined by the course instructor and non-grade sanctions determined by the School or College where the course is offered as described in the Violation and Sanction Classification Rubric. SU students are required to read an online summary of the University's academic integrity expectations and provide an electronic signature agreeing to abide by them twice a year during pre-term check-in on MySlice.

**Religious observances policy.** Syracuse University's Religious Observances Policy recognizes the diversity of faiths represented among the campus community and protects the rights of students, faculty, and staff to observe religious holy days according to their tradition. Under the policy, students are provided an opportunity to make up any examination, study, or work requirements that may be missed due to a religious observance provided they notify their instructors no later than the end of the second week of classes. For fall and spring semesters, an online notification process is available through MySlice (Student Services -> Enrollment -> My Religious Observances) from the first day of class until the end of the second week of class.

## Suggested Pacing and Assignments

The following schedule includes the class Day, Date, Textbook Section, Homework Exercises, and Key Points. Exam dates are also listed. Modifications and other assignments will be announced by your instructor and/or recitation leader.

<b>Chapter 1. Linear Functions and Change</b>			
Day 1: Mon. 1/14	1.1	7, 9-15, 20-25, 36, 39,42,43,46	
<b>1.1.Functions and function notation</b> <ul style="list-style-type: none"> <li>• The definition of a function</li> <li>• Numerical, graphical and symbolic examples</li> <li>• The vertical line test</li> <li>• Basic function concepts and language</li> </ul>			
Day 2: Wed. 1/16	1.2	S9,S10, 8,10-16,19,20,29,31	
<b>1.2.Rate of Change</b> <ul style="list-style-type: none"> <li>• The average rate of change of a function over an interval</li> <li>• Increasing and decreasing functions</li> <li>• Rate of change in function notation</li> </ul>			
Day 3: Fri. 1/18	1.3	4-9,13-18,20,29	
<b>1.3 Linear Functions</b> <ul style="list-style-type: none"> <li>• Functions with a constant rate of change</li> <li>• Construction of linear models</li> <li>• Slope and the general form of a linear function</li> </ul>			
Day 4: Wed. 1/23	1.4	S3,S5,S9,1,3,4,5,7,8,10,11,16,19,20,31,33,35,42,43,46,52,54	
<b>1.4 Formulas for Linear Functions</b> <ul style="list-style-type: none"> <li>• Finding the formula representing a linear function from numerical data, the graph of a function or a verbal description.</li> <li>• Parallel and perpendicular lines</li> <li>• Horizontal and vertical lines</li> </ul>			
Day 5: Fri. 1/25	1.5	2,3,8-11,22	
<b>1.5 Modeling with Linear Functions</b> <ul style="list-style-type: none"> <li>• Interpreting the effects of different rates of change and the initial values on the graphs of linear functions</li> <li>• Interpreting parameters of a linear graph</li> <li>• The intersection of two lines</li> <li>• Linear inequalities in two variables</li> </ul>			
<b>Chapter 2. Functions</b>			
Day 6: Mon. 1/28	2.1	S3,S4,S9,S10,1-4,23-28,32,35	
<b>2.1 Input and Output</b>			

- Basic function interpretation and manipulation using standard function notation
- The effect on a function of changing the input variable versus changing the output variable

2.2 S1-S4,1,2,5,6,8,9,10,13,15,31,36,37

## 2.2 Domain and Range

- Domain and range of a function
- Using a graph to find the domain and range
- Finding domain and range algebraically

Day 7: Wed. 1/30 2.3 2-5,8-11,13,21,22,26

## 2.3. Piecewise Defined Functions

- Piecewise functions
- Absolute value functions

Day 8: Fri. 2/1 2.5 S2,S4,S11,5-12,34-37,39

## 2.5. Composite and Inverse Functions

- The concept of composite functions
- The concept of inverse functions
- Finding the composition of function algebraically
- Finding the formula for an inverse function

10.1 1, 2, 6, 17-21, 25, 26, 30, 31, 59, 70, 71

## 10.1 Composition of Functions

- Finding the composition of two functions numerically, graphically and symbolically
- Interpreting the composition of two functions
- Decomposing a function

Day 9: Mon. 2/4\* 2.6 1,2,9,13,15,18,20,25

\*Financial/Academic Drop Deadline

## 2.6. Concavity

- The relationship between the behavior of the rate of change of a function and the concavity of the function's graph

## Chapter 3. Quadratic Functions

Day 10: Wed. 2/6 3.1 S4,S5,S9,S10,1,3,6,9,10,12,13,15,26,27,35,37,41

## 3.1. Introduction to the Family of Quadratic Functions

- The general formula for quadratic functions
- Finding the zeros of a quadratic function
- Concavity of quadratic functions

Day 11: Fri. 2/8 3.2 1-4,6,7,9,10,11,27,28,29,31,33,34,45

## 3.2. The Vertex of a Parabola

- The vertex form for a quadratic function
- Completing the square

- Modeling with quadratic functions

Exam review

### Major Assessment

Day 12: Mon. 2/11 Exam 1

### Chapter 4. *Exponential Functions*

Day 13: Wed. 2/13 4.1 S1-S4,1,2,3,8,18,20,21,24,29,32-34,40,51,52,56

#### 4.1. Introduction to the Family of Exponential Functions

- Growth factors and growth rates
- Decay factors and decay rates
- The definition of an exponential function

Day 14: Fri. 2/15 4.2 S3,S4,1,2,4,6,8,10,15,20,28-30,35,37,48,49

#### 4.2 Comparing Exponential and Linear Functions

- How to determine when a function is linear
- How to determine when a function is exponential
- Finding formulas for exponential functions

Day 15: Mon. 2/18 4.3 1,3,5,11-14,18,25-30,36,40,42,43

#### 4.3. Graphs of Exponential Functions

- The possible appearances of the graphs of exponential functions
- The effect of the initial value on the appearance of the graph of an exponential function
- The effect of the growth factor on the appearance of the graph of an exponential function
- Why exponential functions have horizontal asymptotes
- Understanding limit notation and limits to infinity

Day 16: Wed. 2/20 4.4 1, 3, 5,6-10,19,20,21

#### 4.4. Applications to Compound Interest

- Basic facts about compound interest
- Nominal versus effective rates
- Apply interest rate formula  $B=P(1+r/n)^{nt}$

4.5 3-5,8-11,20-22

#### 4.5. The number $e$

- Basic facts about the number  $e$
- Continuous growth rates

## Chapter 5. Logarithmic Functions

Day 17: Fri. 2/22

5.1.

1,3,5,7,8,11-16,22-27,35,36,51,53,54,57,63,67,68

### 5.1. Logarithms and their properties

- Using logarithms to solve exponential equations
- The definition of the logarithm function
- The equivalence of exponential and logarithmic expressions
- The inverse relationship between the  $y = \log(x)$  and  $y = 10^x$

Day 18: Mon. 2/25

5.2

2,5,9,11,15,16,23,27,39,42,43,45,55

### 5.2. Logarithms and exponential models

- Using logarithms to determine doubling time and half-life for exponential growth and decay models
- Conversion between different bases in exponential functions

Day 19: Wed. 2/27

5.3

S7,S9,1,3,5,7,9,10,32,54

### 5.3 The Logarithmic Function and Its Applications

- Domain and range of the common logarithm function
- The graph of the common logarithm function
- Applications of logarithms to sound and pH levels
- Asymptotes of the common logarithm function
- Using limit notation to understand asymptotes

## Chapters 2 and 6. Transformations of Functions and Their Graphs

Day 20: Fri. 2/29

2.4

1,3-6,7,8,10,18

### 2.4. Horizontal and Vertical Shifts

- Horizontal and vertical graphical shifts
- Finding a formula for a shifted graph in terms of the formula for the original graph

6.1

S8,S10,1,9,10,14,16,18-21,26,27,32-34

### 6.1. Shifts, Reflections and Symmetry

- Reflections across the  $x$  or  $y$ -axis
- Symmetry
- Algebraic and geometric descriptions of even and odd functions

Day 21: Mon. 3/4

6.2

S4,1,2,8,11,12,15,22,28,29,39

### 6.2. Vertical Stretches and Compressions

- The effect of multiplying a function by a constant

6.3

S4,S11,S16,1,8,11-17,19,25,32-37,49,50

### 6.3. Horizontal Stretches and Combinations of Transformations

- Understanding the effect of multiplying the input variable of a function by a constant
- Understanding the effects of multiple transformations applied in succession

Day 22: Wed. 3/6		
Flex Day / Exam Review		
<b>Major Assessment</b>		
Day 23: Fri. 3/8	Exam 2	
<b>Chapter 7. Trigonometry and Periodic Functions</b>		
Day 24: Mon. 3/18	7.1	1,10,12,23,25,27,29
	7.2	1,10,11,12,14,19,23,25,34
<b>7.1. Introduction to periodic functions</b>		
<ul style="list-style-type: none"> <li>• Graphing a periodic function</li> <li>• Amplitude, midline and period</li> </ul>		
<b>7.2. The Sine and Cosine Functions</b>		
<ul style="list-style-type: none"> <li>• The definitions of the cosine, sine and tangent functions in terms of the unit circle</li> <li>• Reference angles</li> </ul>		
Day 25: Wed. 3/20	7.3	1,2,3,5,6,7,10,12,21,22,25,27,29,31,32,35-38,55
<b>7.3. Radians and Arc Length</b>		
<ul style="list-style-type: none"> <li>• Angles on the unit circle (What is an angle?)</li> <li>• Positive and negative angles</li> <li>• Radian measure of angles (What is a radian?)</li> <li>• Converting between degrees and radians</li> <li>• Arc length</li> </ul>		
Day 26: Fri. 3/22.	7.4	1,2,5,7,17,19,21,27,28,38
<b>7.4. Graphs of the Sine and Cosine</b>		
<ul style="list-style-type: none"> <li>• Graphing <math>y = A\sin(t)</math> and <math>y = A\cos(t)</math></li> <li>• Graphing <math>y = \sin(t) + k</math> and <math>y = \cos(t) + k</math></li> <li>• Amplitude, period, and midline</li> </ul>		
Day 27: Mon. 3/25	7.5	1,2,5,7,13,15,18
<b>7.5. Sinusoidal Functions</b>		
<ul style="list-style-type: none"> <li>• Graphing <math>y = A\sin(B(t-h)) + k</math> and <math>y = A\cos(B(t-h)) + k</math></li> <li>• Amplitude, period, frequency and horizontal shift</li> <li>• Finding formulas for periodic functions using sine and cosine</li> </ul>		
Day 28: Wed. 3/27	7.6.	2-10, 11-14, 21, 24, 25, 27, 35
<b>7.6. The Tangent Function</b>		
<ul style="list-style-type: none"> <li>• The definitions of the tangent function</li> <li>• Trigonometric identities</li> </ul>		
	7.7.	4-6, 9, 12, 15, 17, 18, 20, 21

<b>7.7. Trigonometric Relationships and Identities</b>		
<ul style="list-style-type: none"> <li>Understanding the relationships between the sine, cosine, and tangent functions</li> </ul>		
Day 29: Fri. 3/29	7.8	1-3, 4-7,12,13,14,15,19,21,25,30,31,32-34,36
<b>7.8. Inverse Trigonometric Functions</b>		
<ul style="list-style-type: none"> <li>Introduction to the inverse trigonometric functions</li> </ul>		
Day 30: Mon. 4/1-	8.1	3,4,6,7,9,11,13,14,19,27,28
<b>8.1 Trig Functions and Right Triangles</b>		
<ul style="list-style-type: none"> <li>The sine and cosine functions in right triangles</li> <li>The tangent Function in Right Triangles</li> <li>The inverse trigonometric functions for triangles 2</li> </ul>		
Day 31: Wed. 4/3	9.1	2, 3, 7, 12, 15, 18, 21, 39, 40, 41
<b>9.1. Trigonometric Equations</b>		
<ul style="list-style-type: none"> <li>Solving trigonometric equations graphically and algebraically</li> <li>Multiple solutions</li> </ul>		
Day 32: Fri. 4/5	9.2	1, 4, 10, 14, 20, 31, 35, 39, 40, 50, 54
<b>9.2. Identities, expressions, and equations</b>		
<ul style="list-style-type: none"> <li>The difference between an equation and an identity</li> <li>The Pythagorean and double angle identities</li> </ul>		
Day 33: Mon. 4/8	<b>Trig review / Flex day for Chapters 7, 8, 9</b>	
Day 34: Wed. 4/10	11.2	1,3,4,8,10,18,19,21,22,23,25,44
<b>11.2 Polynomial Functions</b>		
<ul style="list-style-type: none"> <li>Standard terminology associated with polynomials</li> <li>The long-run behavior of polynomials</li> <li>Zeros of polynomials</li> </ul>		
Day 35: Fri. 4/12	11.3	S1-S5,1,2,5,9,11,15,18-21,27,30,33,35,44
<b>11.3 The Short-Run Behavior of Polynomials</b>		
<ul style="list-style-type: none"> <li>Factored form of a polynomial</li> <li>Multiple zeros</li> <li>Reconstructing the formula for a polynomial from its graph</li> </ul>		
<b>Chapter 11. Polynomial and Rational Functions</b>		
Day 36: Mon. 4/15	11.4	S2,S3,S9,1,4,8,13-15,17-21,27,35
<b>11.4 Rational Functions</b>		
<ul style="list-style-type: none"> <li>Graphs and formulas of rational functions</li> <li>Horizontal asymptotes: long-run behavior</li> </ul>		
Day 37: Wed. 4/17	11.4	S2,S3,S9,1,4,8,13-15,17-21,27,35
<b>11.4 Rational Functions, cont.</b>		

Day 38: Fri. 4/19	11.5	1,3,5,6,8,9,14,15,20,21,32
<b>11.5 The Short Run Behavior of Rational Functions</b> <ul style="list-style-type: none"> <li>• Zeros of rational functions</li> <li>• Locating vertical asymptotes of rational functions</li> <li>• Local behavior of rational functions</li> <li>• Using limits from the left and from the right to investigate local behavior • Factored form</li> <li>• Holes in graphs of rational functions</li> </ul>		
Day 39: Mon. 4/22	11.5	1,3,5,6,8,9,14,15,20,21,32
<b>11.5 The Short Run Behavior of Rational Functions, cont.</b>		
Day 40: Wed. 4/24		
Review for Exam 3 / flex day		
<b>Major Assessment</b>		
Day 41: Fri. 4/26	Exam 3	
Day 42: Mon. 4/29	Comprehensive Review	
<b>Major Assessment</b>		
Mon. 5/6	<b>Final Comprehensive Exam (2 HR block from 8:00AM - 2:30PM – specific time TBA)</b>	