

MATH 140B

CALCULUS WITH APPLICATIONS IN BIOLOGY
AND THE NATURAL SCIENCES
FALL 2014

CATALOGUE DESCRIPTION: Math 140B (GQ) Calculus and Biology I (4). Functions, limits, analytic geometry; derivatives, differentials, applications from biology; integrals, applications from biology. Students may take only one course for credit from MATH 110, 140, 140A, and 140B.

PREREQUISITES: MATH 022, MATH 026; or MATH 040 or MATH 041, or satisfactory performance on mathematics placement examination.

TEXTBOOK: *Calculus for the Life Sciences* by Bittinger, Brand and Quintanilla. 1st ed. 2006. Pearson Addison Wesley, ISBN 0-321-27935-2. In addition, the course will use parts of *Differential Calculus*, by Leah Edelstein-Keshet, The University of British Columbia, 2014 (the relevant sections will be distributed by your Instructor).

LEARNING OBJECTIVES: Upon successful completion of Math 140B, the student should be able to

1. Calculate or estimate limits of functions given by formulas, graphs, or tables.
2. Determine whether a function given by a graph or formula is continuous at a given point or on a given interval or on its domain.
3. Determine whether a function given by a graph or formula is differentiable at a given point or on a given interval.
4. Distinguish between average and instantaneous rate of change and interpret the definition of the derivative graphically.
5. Determine derivatives of some functions using the limit definition of the derivative.
6. Calculate derivatives of polynomial, rational, and common transcendental functions, and combinations of these functions.
7. Calculate derivatives of composite functions.
8. Calculate derivatives of implicitly defined functions.
9. Apply the ideas and techniques of derivatives to related rate problems.
10. Apply the ideas and techniques of derivatives to finding local and absolute extrema.
11. Apply the ideas and techniques of derivatives to graphing functions.
12. Apply the ideas and techniques of derivatives to optimization problems.
13. Find linear approximations of functions (differentials).
14. Calculate the Riemann sum for a given function and partition.
15. Describe a definite integral as the limit of a Riemann sum.
16. Determine antiderivatives of some algebraic functions and some trigonometric functions.

17. Calculate values of definite integrals using antiderivatives and areas.
18. Use the Fundamental Theorem of Calculus to determine the derivative of an integral.
19. Use the Fundamental Theorem of Calculus to evaluate definite integrals.
20. Apply substitution techniques to integrate functions.
21. Apply the ideas of definite integrals to calculate the area of a region between curves.
22. Synthesize concepts from two or more separate sections of the text.

CALCULATORS: A calculator is a great tool for crunching numbers – especially when working examples with messy constants – as well as a useful study tool. They are not, however, necessary to understand and apply the concepts of the course to examples with simple coefficients. Calculators *will not be allowed* during quizzes or exams (the important coefficients will be simple enough to do by hand).

TUTORS AND MATH CENTER: Free mathematics tutoring is available at Penn State Learning located in 220 Boucke Building starting September 3rd. For more information, go to the [PSU Learning website](#).

EXAMINATIONS: Two 75-minute evening examinations will be given during the semester and a comprehensive final examination will be given during the final examination period. *Absolutely no books, notes, or calculators may be used during the examinations.* You must bring your University ID card to all exams. The examinations will be given from 6:30 to 7:45 PM on the following dates:

Midterm I	October 8
Midterm II	November 5

Rooms for examinations will be announced by your instructor at a later date and may also be found on the [courses](#) website when they are available. It is not permissible to take the exam in a different instructor's assigned room.

CONFLICT & MAKEUP EXAM POLICIES In addition to the two regularly scheduled midterm examinations, the math department provides two options for students who are unable to attend at the scheduled time: a conflict exam and a makeup exam. Please be sure you know the difference

- A *conflict exam* for each of the midterms is offered on the same night as the regularly scheduled exam at a different time (specifically, 5:05 - 6:20 PM). Students who attend the conflict exam will not be permitted to leave before 6:25.
- A *makeup exam* is scheduled on an evening different from that of the regularly scheduled exam. If you need to schedule the conflict exam, you must sign up at least one full week ahead of the scheduled exam date.

If you think you will not be able to take the regularly scheduled exam, *please be sure to verify if you are eligible to take the conflict or makeup, as well as supply the necessary documentation.* In order to qualify for either the conflict or makeup exam, you must have a valid conflict or makeup reason. Sign-up sheets for both the conflict exam and the makeup exam will be distributed by your instructor during class. It is the student's responsibility to sign up and to note the time and location of the makeup or conflict exam (these specifics can be found at the top of the signup sheet). It is the student's responsibility to sign up on the appropriate sheet.

NOTE: If you miss an exam without an official excuse (such as illness or official university business), you may be allowed to take a makeup exam, at a 20 % penalty to your exam grade. To avoid this penalty, you must notify your instructor with your official excuse, before the date and time of the exam. You may provide notification in person, via e-mail, or by telephone.

WHO MAY TAKE THE CONFLICT EXAM? If you have a valid conflict with the regular examination time, such as a class or another official university activity, you may sign up for the conflict exam. If a student has not signed up for the conflict exam, he or she will not be permitted to take the exam.

INSTRUCTIONS ON CONFLICT EXAM NIGHT. The student is responsible for knowing the room and time of the conflict examination. Each student must bring his or her University ID to the conflict examination. The ID will be checked by the proctor. Although the conflict examination will end at 6:20 PM, no student will be permitted to leave the examination room before PM. Any student who leaves before 6:25 PM will receive a grade of zero on the examination and will not be allowed to retake it.

WHO MAY TAKE THE MAKEUP EXAM? Students who have a valid documented reason, such as a class conflict or illness, during both the conflict and regular examination times are permitted to schedule a makeup examination with no penalty. You must be prepared to verify the reason for taking the makeup. Personal business, such as travel, employment, weddings, graduations, or attendance at public events such as concerts, sporting events, and Greek Rush events, is not a valid excuse. Forgetting the date, time or room of an examination is not a valid excuse. Students who do not have a valid reason for missing the examination are permitted to schedule the makeup, but at a 20 % penalty. Students who have taken either the regularly scheduled examination or conflict examination are not permitted to take the makeup examination. The makeup examinations are given from 6:30 to 7:45 PM on the evenings listed below:

Makeup Midterm I	October 16
Makeup Midterm II	November 13

HOW AND WHEN TO SIGN UP FOR THE MAKEUP EXAM: A students who is ill on exam night must contact his or her instructor within 24 hours of the exam. Students must sign

up for the Makeup Exam in class on the provided yellow form, as soon as possible following the regular exam date. The student is responsible for knowing the room and time of the makeup examination. This information is on the yellow form. Instructors must turn in the yellow form three class days prior to the examination date. If a student has not signed up with his or her instructor, the student will not be allowed to take the makeup exam.

INSTRUCTIONS ON MAKEUP EXAM NIGHT: The student is responsible for knowing the room and time of the makeup examination. Each student must bring his or her PSU ID to the makeup examination. The ID will be checked by the proctor.

WHAT IF A STUDENT MISSES BOTH THE REGULARLY SCHEDULED EXAM AND THE MAKEUP EXAM? If a student misses both the regularly scheduled examination and the scheduled makeup due to a valid, verifiable reason, it may be possible to take a makeup examination by appointment. All such makeup examinations must be scheduled through the classroom instructor with the approval of the course coordinator and must be completed no later than one week after the scheduled makeup examination.

FINAL EXAMINATION: The final examination will be given during the week, **December 15-19, 2014**. **The final examination may be scheduled on any day during the final examination period. Do not plan to leave University Park until after Friday, December 19, 2014.** Students may access their final exam schedules **Monday, September 29**, through their e-lion accounts. Notification of conflicts is given on the student's final exam schedule. There are two types of conflict examinations: direct and overload. Direct conflicts are two examinations scheduled at the same time. Overload examinations are three or more examinations scheduled within a fifteen hour period, from the beginning of the first examination to the beginning of the third examination. Students may elect to take the three or more examinations on the same day if they wish or request a conflict final examination. A student must take action to request a conflict exam through e-lion between September 29 and October 19, 2014. Conflict final examinations cannot be scheduled through the Mathematics department, and there will be no sign up sheet in class for the final conflict examination. Students who miss or cannot take the final examination due to a valid and documented reason, such as illness, may be allowed to take a makeup final examination at the beginning of the next semester. **Personal business, such as travel, employment, weddings, graduations, or attendance at public events such, as concerts and sporting events are not valid excuses. Forgetting the date, time, or room of an examination is not a valid excuse.** If the student does not have a valid reason, a 25% penalty will be imposed. All such makeup examinations must be arranged through the instructor with the approval of the course coordinator, and students in such a situation should contact their instructor within 24 hours of the scheduled final examination. Students who have taken the original final examination are not permitted to take a makeup examination.

COURSE GRADES: Grades will be calculated from a total of 500 points, distributed as follows:

Midterm I	100 points
Midterm II	100 points
Homework & Quizzes	150 points
Final Exam	150 points
TOTAL	500 points

Final course grades will be assigned as follows:

Grade	Raw Score	Percent Score
A	465-500 points	93% - 100%
A-	450-464 points	90% - 92%
B+	435-449 points	87% - 89%
B	415-449 points	83% - 86%
B-	400-414 points	80% - 82%
C+	385-399 points	77% - 79%
C	350-384 points	70% - 76%
D	300-349 points	60% - 69%
F	0 - 299 points	0% - 59%

NOTE: Your grade will be based exclusively on the midterm examinations, homework and/or quizzes and the final examination. There is no "extra-credit" work.

DEFERRED GRADE: Students who are currently passing a course but are unable to complete the course because of illness or emergency may be granted a deferred grade which will allow the student to complete the course within the first six weeks of the following semester. Note that deferred grades are limited to those students who can verify and document a valid reason for not being able to take the final examination. For more information see [DF grade](#).

LATE-DROP: Students may add/drop a course without academic penalty within the first ten calendar days of the semester. A student may late drop a course within the first twelve weeks of the semester but accrues late drop credits equal to the number of credits in the dropped course. A baccalaureate student is limited to 16 late drop credits. The late drop deadline for [Fall 2014](#) is [November 14, 2014](#).

ACADEMIC INTEGRITY: Academic integrity is the pursuit of scholarly activity in an open, honest and responsible manner. Academic integrity is a basic guiding principle for all academic activity at The Pennsylvania State University, and all members of the University community are expected to act in accordance with this principle. Consistent with this expectation, the University's Code of Conduct states that all students should act with personal integrity, respect other students' dignity, rights and property, and help create and maintain an environment in which all can succeed through the fruits of their efforts.

Academic integrity includes a commitment not to engage in or tolerate acts of falsification, misrepresentation or deception. Such acts of dishonesty violate the fundamental ethical principles of the University community and compromise the worth of work completed by others. Academic dishonesty includes, but is not limited to, cheating, plagiarizing, [...], facilitating acts of academic dishonesty by others, having unauthorized possession of examinations, submitting work of another person or work previously used without informing the instructor, or tampering with academic work of other students. [...] A student charged with academic dishonesty will be given oral or written notice of the charge by the instructor. If students believe that they have been falsely accused, they should seek redress through informal discussions with the instructor, the department head, dean or campus executive officer. If the instructor believes that the infraction is sufficiently serious to warrant the referral of the case to Judicial Affairs, or if the instructor will award a final grade of F in the course because of the infraction, the student and instructor will be afforded formal due process procedures.

From Policies and Rules, Student Guide to the University Policy 49-20.

Based on the University's [Faculty Senate Policy 49-20](#), a range of academic sanctions may be taken against a student who engages in academic dishonesty. Please see the [Eberly College of Science Academic Integrity homepage](#) for additional information and procedures.

QUESTIONS, PROBLEMS, OR COMMENTS: If you have questions or concerns about the course, please consult your instructor first. If further guidance is needed, you may contact the course coordinator whose contact information is given below.

COURSE COORDINATOR:

Dr. Eric Simring, Senior Lecturer and Biology Calculus Coordinator

108 McAllister Building

University Park, PA 16802

Telephone: 814-865-7528

E-mail: eis108@psu.edu

Please be sure to include your Name, Student ID, Course, and Section Number in any correspondence.

SUGGESTED LECTURE SCHEDULE

WEEK	DAY	DATE	SECTION(S)	TOPIC	COMMENTS
1	Monday	25-Aug	Introduction	Introduction to Calculus	CLASS BEGINS
	Tuesday	26-Aug	1.1	Tangent & Velocity Problems	
	Wednesday	27-Aug	1.1-1.2	Linear Functions & Polynomials	
	Friday	29-Aug	1.3	Rational Functions, Applications	
2	Monday	1-Sep	NO CLASS		LABOR DAY
	Tuesday	2-Sep	1.3	Radical Functions	DROP ENDS
	Wednesday	3-Sep	1.4	Trigonometric Functions	
	Friday	5-Sep	1.5	Trigonometry & Applications	
Monday	8-Sep	2.1	Limits & Continuity: Geometrical Interpretation		
3	Tuesday	9-Sep	2.1	Limits & Continuity: Geometrical Interpretation	
	Wednesday	10-Sep	2.2	Limits & Continuity: Algebraic Interpretation	
	Friday	12-Sep	2.2	Limits & Continuity: Algebraic Interpretation	
	Monday	15-Sep	2.3	Average Rates of Change	
Tuesday	16-Sep	2.4	Derivatives from Limits		
Wednesday	17-Sep	2.4, 2.6	Derivatives from Limits, Instantaneous Rates of Change		
Friday	19-Sep	2.5	Introduction to Differentiation		
5	Monday	22-Sep	2.7	Product Rule	
	Tuesday	23-Sep	2.7	Quotient Rule	
	Wednesday	24-Sep	2.8	Chain Rule	
	Friday	26-Sep	2.8	Chain Rule	
6	Monday	29-Sep	2.9	Higher Order Derivatives	
	Tuesday	30-Sep	3.1	First Derivatives, Local Extrema	
	Wednesday	1-Oct	3.1	First Derivatives, Local Extrema, Curve Sketching	
	Friday	3-Oct	3.2	Second Derivatives, Concavity	
7	Monday	6-Oct	3.2	Second Derivatives, Concavity, Curve Sketching	MIDTERM I
	Tuesday	7-Oct	Ch. 1 & 2	Midterm Review	
	Wednesday	8-Oct	Ch 3	Midterm Review	
	Friday	10-Oct	3.3	Rational Functions, Asymptotes	
8	Monday	13-Oct	3.4	Rational Functions, Asymptotes, Curve Sketching	
	Tuesday	14-Oct	3.4	Absolute Extrema, Max & Min	
	Wednesday	15-Oct	3.5	Absolute Extrema, Max & Min	
	Friday	17-Oct	3.5	Optimization: Max & Min	
9	Monday	20-Oct	3.5	Optimization: Max & Min	
	Tuesday	21-Oct	3.5	Optimization: Max & Min, Applications	
	Wednesday	22-Oct	3.6	Approximation Techniques	
	Friday	24-Oct	3.6	Approximation Techniques	

10	Monday	27-Oct	3.6	Approximation Techniques	
	Tuesday	28-Oct	3.7	Implicit Differentiation & Related Rates	
	Wednesday	29-Oct	3.7	Implicit Differentiation & Related Rates	
	Friday	31-Oct	3.7	Related Rates & Applications	
11	Monday	3-Nov	3.1-3.5	Midterm Review	MIDTERM II
	Tuesday	4-Nov	3.5-3.7	Midterm Review	
	Wednesday	5-Nov	Ch 3	Midterm Review	
	Friday	7-Nov	Ch 4	Introduction to Exponential & Logarithmic Functions	
12	Monday	10-Nov	4.1	Exponential Functions	LATE DROP DEADLINE
	Tuesday	11-Nov	4.1, 4.2	Exponential and Logarithmic Functions	
	Wednesday	12-Nov	4.2	Logarithmic Functions	
	Friday	14-Nov	4.3	Applications: Uninhibited Growth	
13	Monday	17-Nov	4.3	Applications: Uninhibited Growth	
	Tuesday	18-Nov	4.4	Applications: Decay	
	Wednesday	19-Nov	4.4	Applications: Decay	
	Friday	21-Nov	Ch 4	Review	
14	THANKSGIVING BREAK				
15	Monday	1-Dec	5.1	Antiderivatives & Integrals	
	Tuesday	2-Dec	5.2	Areas and Accumulations	
	Wednesday	3-Dec	5.3	The Fundamental Theorem of Calculus	
	Friday	5-Dec	5.3	The Fundamental Theorem of Calculus	
16	Monday	8-Dec	5.4	Techniques of Integration	CLASS ENDS
	Tuesday	9-Dec	5.4	Techniques of Integration	
	Wednesday	10-Dec	Review	Chapters 2 & 3	
	Friday	12-Dec	Review	Chapters 4 & 5	