Math 140 [N]: Calculus for the Life Sciences
Section 1; Spring 2008; SLN 71472

Class: MWF 12:00-13:15 VMMC 16

Instructor: Dr. Nandini Ranganathan
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Office Hours: T,Th 10am — 11am; W 10:00 am — 11:30 am and by appointment.

Course description: Functions and their graphs. Properties and applications of various important families of functions including polynomial and rational functions, exponential and logarithmic functions, and trigonometric functions. (4 Credits)

Pre-requisites: Math 107 with a grade of C or better. Or satisfactory math placement scores, transfer credit, SAT or ACT scores.

Required Text: Greenwell, Richey, Lial: *Calculus for the Life Sciences*. Addison Wesley, 2003. 1st Edition

Syllabus: The course includes a brief review of relevant material from precalculus. The main concepts of differential calcu.us, integration, multivariable calculus and differential equations will be covered as well as several applications. Time permitting, the course will cover many of the sections from chapters 3 through 11 of the text.

We will skim through some of the sections that, although interesting, are not essential to understanding the concepts. While we may not cover all of the examples and applications given in the text in detail, I encourage you to take the time to read these examples carefully and try to understand them. Please be prepared to take notes in class; you will be responsible for any information discussed in class.

Course Objectives: The primary goal of this particular mathematics course is to understand and predict change in dynamical systems modelled by mathematical functions. Functions give us a framework to model any changing phenomena that we encounter and enable us to to predict change and determine long term behaviour. We will focus on understanding the behaviour of important families of functions that occur in a variety of applications including population models, environmental and climate models, and in the health sciences. Students will develop their ability to apply the mathematics that they learn toward problems that are relevant to their needs and interests.

The material taught in this course links particularly well with Ecology (Biology 372) and Statistics 412. The campus theme, *Global Change in a Local Context*, will be addressed as we work with several models that discuss climate and environmental change, concentrations of pollutants, and population dynamics.

This course addresses the *quantitative and symbolic reasoning* component of WSUV's educational mission. It will develop the students' logical reasoning and problem-solving skills and their ability to think critically about issues involving numerical data. Students are expected to use the tools we learn to represent, interpret, and evaluate data, and to make reasonable estimates. Students will learn how to use the mathematical machinery we develop to analyze and solve problems, and will learn to effectively communicate their solutions. Students will become familiar with formal mathematical notation, terminology and techniques, and will learn how to effectively use these tools to address both mathematical and non-mathematical problems.

The course emphasizes exploration and understanding of how to use the powerful methods in calculus in a variety of applications. We will analyze the concepts we work with from a variety of perspectives, using visual aids, empirical information, mathematical techniques and examples. We will use technology appropriately to allow us to work on more interesting and complex problems. Projects and assignments will emphasize investigation, critical thinking and analysis rather than rote computation.

Attendance policy: Students are expected to attend class and participate in class discussions. In order to have a context for our discussion, please read the relevant sections before class. After class, it is a good idea to review the section again before attempting the assigned problems. To understand any subject, it is important to engage with the material regularly. Please work on the practice problems daily rather than waiting until the day before they are due.

Homework: Weekly homework assignments will be due in class on Wednesday. Please make sure that the homework is stapled and that you have written your name clearly on each page. Please use a pencil for all assignments and exams.

Solutions to assignments should be written legibly and carefully using complete sentences. A solution is complete if it is mathematically accurate, makes appropriate use of the relevant mathematical notation, and states all assumptions, definitions, theorems and formulae used. Every step of the solution must be clearly demonstrated and your reasoning should be plain to the reader. Graphs must be drawn neatly with axes labelled and relevant points marked. In applications, you are expected to use the given units. You are expected to become familiar with the formal mathematical notation. Streams of symbols, numbers, or formulae on the paper with insufficient reasoning or explanation is not a valid mathematical solution and will be assigned no credit. In general, I expect the solution to be written in such a fashion that you (or anybody else) can read it a year from now and can understand exactly how you solved the problem.

It is essential to work on the assigned problems in order to better understand the material. While I assign many problems, I will grade a few random even-numbered problems each week. You are of course encouraged to practice as many problems as you need to in order to better understand the material and you are welcome to discuss these with me and with the class. The lowest homework score will be dropped in computing your final homework grade.

I encourage you to discuss the problems with your colleagues and with me, and to

work in groups if you would like to. However, you are expected to write up your solutions *independently*. If you have questions about what is (or is not) appropriate collaboration, please come talk to me or refer to the relevant section in the Student Handbook.

Late homework will not be graded unless you have a valid (documented) medical reason. Please arrange with me well in advance if you need to turn in a specific assignment late (or in the case of an emergency, as soon as is reasonably possible). I still encourage you to complete the assignment and discuss the problems with me and your colleagues as these topics may reappear in the exams.

Students taking or who have taken GE101/303/401 must store at least one of their homework sets in their repository within the ePortfolio. These documents will help demonstrate your quantitative and symbolic reasoning skills.

Exams: There will be a quiz and three in-class exams on the following days:
Quiz:
Exam 1: Friday,
Exam 2: Friday,
Exam 3: Friday,

Final Exam: The final comprehensive exam will be on Wednesday, April 30, 2008 from 10:30am – 12:30pm.

Make-up exams: are only allowed with a documented, valid medical excuse.

• Exams will be based on the homework problems and on the material discussed in class. You may not use any notes or texts during the exam. Programmable or graphing calculators will not be allowed on the exams but you may use a basic scientific calculator for computational purposes.

• Questions regarding the grading of work must be handled within one week of the date the material was handed back. For questions regarding the grading of homework, please submit a written description of the problem for me to consider.

Grades: The graded course work includes weekly homework sets, a quiz, three in-class exams, and a comprehensive final. Class participation will also be taken into account. The final grade for the course will be determined as follows:

• Three exams (20%) each + Homework (15%) + Quiz (5 %) final (20%)

• If you have an A average on the homework, and an A on *each* exam, you are exempt from the final and your course grade will be an A.

• If you have at least an $A-$ average on the homework, and at least a $A-$ on *each* exam, you are exempt from the final and your course grade will be a $A-$. You may of course take the final to improve your grade.

Academic Integrity: Academic integrity is the cornerstone of the university and will be strongly enforced in this course. When a student enrolls in Washington State University, the student assumes an obligation to pursue academic endeavors in a man-

ner consistent with the standards of academic integrity adopted by the University. To maintain the academic integrity of the community, the University cannot tolerate acts of academic dishonesty. Academic dishonesty includes cheating, falsification, fabrication, multiple submission, and plagiarism, abuse of academic materials, complicity, or misconduct in research. Any student caught cheating on any assignment will be given an F for the course and will be referred to the Office of Student Conduct. Consult the WSU Student Handbook for further details.

A few reminders about basic classroom etiquette:

- Do not arrive late or leave early as this can be distracting for the class.
- Do not have private conversations during class; even whispering can be distracting.
- Do not read the newspaper or work on assignments for other classes.
- Turn your cell phones off or onto * silent mode.
- Laptops are allowed in lecture as long as they do not become a distraction to the learning environment. Laptops may only be used for note-taking and graphing. Students may not use the internet, play games or email while in class. If laptop users become a distraction to me or others in the class, I will change the policy.
- Please turn all sounds off any electronic devices (cell-phones, laptops, pagers, etc.) that you may be carrying.

Disability Accommodation: Accommodations may be available if you need them in order to fully participate in this class because of a disability. Accommodations may take some time to implement so it is critical that you contact Disability Services as soon as possible. All accommodations must be approved through Disability Services, located in the Student Resource Center on the Lower Level of VSSC. (360) 546-9155.

Academic Calendar: The Academic Calendar is posted on the following website: *http://www.vancouver.wsu.edu/ss/calendars.htm*

Weather policy: For emergency weather closure policy, see: *http://www.vancouver.wsu.edu/adm/fo/psafety/weather.htm*

Evacuation policy: Emergency evacuation plans are posted in each classroom. Read and be familiar with these plans. In case of emergency, follow these instructions.

The dates, assignments, topics and policies on this page may be changed at any time. I encourage you to contact me with any questions you may have regarding the information listed here.

Rationale Math 140 [N]: Calculus for the Life Sciences
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1. *Which university goal(s) does your course introduce or emphasize?*

   Mathematics addresses the **Quantitative and Symbolic Reasoning** component of the University's *learning goals*. Students will learn to think clearly and critically about quantitative issues, to improve their decision-making and problem-solving skills, to represent and evaluate data, and understand uncertainty and risk. The material taught in this course gives us a framework to model any phenomena we encounter, and enables us to to predict changes and determine long term behaviour.

2. *When (in conjunction with which course-specific topics) during your course will students engage with this outcome?*

   The students will engage with this outcome for the entire duration of the course. Students are expected to apply the concepts we learn throughout the course to represent, interpret, and evaluate data, and to make reasonable estimates. Students will learn how to use the mathematical machinery to analyze and solve problems, and will learn to effectively communicate their solutions. Students will become familiar with formal mathematical notation, terminology and techniques, and will learn how to effectively use these tools to address both mathematical and non-mathematical problems.

3. *Which activities/assignments/discussions will allow students to practice and assess their progress towards meeting this outcome?*

   All of the graded assignments and class discussions are expected to allow the students to practice and assess their progress toward meeting this goal. All the formulae and concepts taught in the course are motivated using examples and logical derivations. Class discussions and assignments encourage the students to explore assumptions made, alternative models, and arguments for the validity of the model used. Students are expected not just to compute answers but to question whether their estimates or predictions are reasonable, and whether alternate techniques provide more information. In written assignments, students are expected to demonstrate proficiency with the techniques and understanding of the underlying concepts.

4. *How will you determine whether your assignments/discussions/activities assigned to an outcome are effective?*

   There are various ways in which to determine whether the assigned activities are effective. These include looking at the students' solutions to make sure that their assignments satisfy the criterion described in the syllabus: that it *is mathematically accurate, makes appropriate use of the relevant mathematical notation, and states all assumptions, definitions, theorems and formulae used. Every step of the solution should be clearly demonstrated and your reasoning should be plain to the reader .. the solution is to be written in such a fashion that you (or anybody else) can read it a year from now and can understand exactly how you solved the problem.*

   Students' questions and answers in class discussions will also demonstrate whether a student is successfully able to make estimates, determine the validity of these estimates and the models used to compute them, detect patterns, and interpret solutions in applictaions.

5. *How do you intend on incorporating the Campus Theme into your course?*

   The campus theme, *Global Change in a Local Context*, will be addressed multiple times over the course of the semester as we work with several mathematical models related to climate and environmental change, concentrations of pollutants in lakes, and population dynamics.

6. *How will you develop the link from your course to another course?*

   The material taught in this course links particularly well with Ecology (Biology 372) and Statistics 412. We will work quite extensively with the logicitic and exponential models for populations, study predator-prey models. We will study applictaions relevant to the health sciences (for example, models of drug levels in the bloodstream). Of course students are expected to model, analyze and interpret numerical data, to detect trends and to predict future behaviour.

7. *How does the writing in your course contribute to learning and to the course grade?*

   Writing is a signficant component of the course grade. Writing a solution to a mathematical problem requires the student to estimate and check answers and to manipulate mathematical and symbolic notation to compute answers. Students are expected to use a variety of methods to understand and explain the solution including appropriate technology, visual aids like graphs, emperical data, sentences, and of course mathematical and logical arguments. They are expected to interpret the quantities involved in the context of the application and to analyze and interpret the result.

8. *How will you use the ePortfolio to support your course (post assignments, use of the discussion board, method to collect feedback, etc)?*

   Students are expected to post one of their written assignments on the electronic portfolio.

9. *What activities/assignments in your class will result in artifacts which can be stored in the student's repository within the ePortfolio?*

   Students taking or who have taken GE101/303/401 must store at least one of their homework sets in their repository within the ePortfolio. They will then use these documents to help demonstrate your quantitative and symbolic reasoning skills. These assignments include applications where the student uses the given description to set up a mathematical model, finds a solution using the mathematical techniques learned in class. They are then required to interpret and analyze the result in the context of the application and carefully write down their conclusions.