

Patterning the World: Connecting Mathematics and Science – Spring 2014

Program Syllabus

Patterning the World is a 12-credit, one quarter introductory program that integrates the study of mathematics and physics around a theme of *patterns*. We approach the study of patterns from two complementary points of view: the *discovery* of patterns through hands-on work in lab and the *generation* of patterns through mathematical explorations. We will study mathematics as a language of patterns that unifies these viewpoints. As students discover and generate patterns, we will develop and identify mathematical structures that describe and help make sense of those patterns. Students who successfully complete this program should

- become mathematically and scientifically capable and confident,
- improve habits for achieving success in future work especially in math and science, and
- develop increasingly sophisticated skills for learning from text and a variety of other resources.

Program Faculty

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Program Support

Kirana Bergstrom – Teaching Assistant
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Required Texts & Materials

- *Precalculus: An Investigation of Functions*, available freely at <http://www.opentextbookstore.com/precalc/>. We will be working through most of this text. Rather than printing out the entire textbook, you may want to consider ordering the text from one of the links available at the textbook website.
- *College Physics*, available freely at <http://openstaxcollege.org/textbooks/college-physics>. We will work through a few selected chapters of this textbook so you may not want to order the entire text.
- You must have access to your own copy of these texts, as full participation in class activities requires your own copy to work from (electronic versions are fine as long as you have the capacity to annotate).
- A scientific calculator that in addition to the basic arithmetic functions is capable of powers, roots, trigonometric functions (sin, cos, tan), exponential and logarithmic functions, and the inverse of those functions. Such calculators are available for <\$20. If you already have a graphing calculator, that is fine. Also, there are many calculator apps (free or inexpensive) available for smartphones, and one of those would be fine as well.
- 3-ring binder.
- 3 bound notebooks: one for reading/lecture notes, one for problem sets, and one for lab. You may choose to have 6 bound notebooks, having a set of 3 for each of math and physics.
- Access to WAMAP, an on-line homework system for submitting your pre-calculus homework (free).
- Access to WebAssign, an on-line homework for submitting your physics homework (purchase required, <\$40).

Program Learning Goals

Through your work in the program, you will make progress towards meeting many of the “Expectations of an Evergreen Graduate”, including how to:

- 1) articulate and assume responsibility for your own work;
- 2) participate collaboratively and responsibly in our diverse society;
- 3) communicate creatively and effectively;
- 4) demonstrate integrative, independent, critical thinking;
- 5) apply qualitative, quantitative and creative modes of inquiry appropriately to practical and theoretical problems across disciplines;
- 6) demonstrate breadth and synthesis of learning and the ability to reflect on the personal and social significance of that learning.

Additional program goals are taken from the Common Core States Standards for Mathematical Practice and the Next Generation Science Standards. You will have opportunities to develop your abilities to:

- 1) make sense of problems and persevere in solving them;
- 2) reason abstractly and quantitatively;
- 3) model with mathematics;
- 4) use appropriate tools strategically;
- 5) attend to precision;
- 6) analyze and interpret data;
- 7) look for and make use of structure/express regularity in repeated reasoning;
- 8) construct viable explanations from evidence and discuss (with an eye to improving) the reasoning of others;
- 9) obtain, evaluate, and communicate information.

Program Schedule and Activities

All students will participate in **Lectures & Lecture/Seminars**, **Physics Labs**, **Math Labs**, **Wednesday Workshop**, **Problem Sessions**, and the **Weekly Wrap**.

Monday		Tuesday		Wednesday		Thursday	
8:30 – 9:45 Lecture Lecture Hall 4		8:30 – 9:15 Lecture Lecture Hall 5		8:30 – 10:00 Physics Lab Lab 1 2046	8:30 – 10:00 Workshop Sem 2 A2105	9:00 – 10:45 Problem Session Sem 2 A2105	
10:00 – 12:00 Physics Lab Lab 1 2046	10:15 – 12:00 Lecture/Seminar Sem 2 A2105	9:30 – 12:00 Math Lab (Computer Applications Lab: Lab 2, 1 st floor)		10:30 – 12:00 Physics Lab Lab 1 2046	10:30 – 12:00 Workshop Sem 2 A2105	11:00 – 12:00 Wrap Sem 2 A2105	
1:00 – 3:00 Physics Lab Lab 1 2046	1:00 – 2:45 Lecture/Seminar Sem 2 A2105	12:00 – 1:00 (optional) Quiz Makeup/Revision					

Lectures & Lecture/Seminars: In our interactive Lectures and Lecture/Seminars, we will provide context for the program content and skills, work through conceptual difficulties, make connections between our various topics and texts, and gather questions.

Physics Labs: Physics Lab activities will allow us to discover patterns in nature in a structured and supportive environment. Physics Lab will give us hands-on experience and transferable skills with equipment and computers.

Math Labs: In Math Lab, we will analyze patterns discovered in the Physics Labs as well as generate and explore purely mathematical patterns. Math Lab will sometimes be used to support close reading of the program textbooks. We'll be learning tools for both the analysis and generation of patterns.

Wednesday Workshop: Wednesday Workshop offers the opportunity to review and consolidate program material from the current and previous week. You will also practice producing and improving written solutions to some of the more challenging problems from problem sets and quizzes.

Problem Sessions: A set of homework problems will be assigned for each Problem Session. You will attempt all problems before Problem Session and complete as many as you can on your own, then bring both complete and incomplete attempts to Problem Session. You will work in small groups to understand and explain problems that posed particular challenges to you or any group member, with the goal of improving both your private internal understanding and your public external communication of that understanding.

Weekly Wrap: The Weekly Wrap provides an opportunity to account for, collectively reflect on, and synthesize the work of the week and to that point in the program. This session will typically have some combination of discussion and writing.

Assignments and Assessments Overview

Regular weekly assignments include **Reading Assignments**, **Reading Responses and Reflections**, **Problem Sets**, and **Solution Postings and Reviews**. Each week there will be a **Quiz**. In weeks 5 and 10, there will be an **Exam**. Throughout the quarter, you will maintain a **Portfolio** of your work.

Reading Assignments: Each week, you will have Reading Assignments from the math and physics textbooks. These Reading Assignments must be completed in time for you to submit your Reading Responses and Reflections. Details of Reading Assignments are provided at the Calendar links at the program web-site.

Reading Responses and Reflections: For each Reading Assignment, you will have a Reading Response that is due 6 pm Sunday (the evening before the reading is discussed in Lecture or Lecture/Seminar). You will complete these Reading Responses on-line (if you don't have access internet access on Sunday, there are alternatives; please come speak with us). The Reading Responses are intended to help you keep up with the reading, orient you to the material for the upcoming week, and to give your instructor feedback on how best to use our class time, based on what you have difficulty with. You are welcome to use your book and other resources to complete the Reading Response, but should take it individually. The Reading Response is designed to be short (less than 30 minutes); if you find you are regularly taking more than 45 minutes, please communicate with your instructor and discuss with your classmates, teaching assistant, and tutor for strategies for improving your skills for making sense of your texts. In addition to the Reading Responses, students will also write short essay Reflections. In these Reflections, students will provide examples of meeting (or plans to meet) specific program learning goals. Reading Responses and Reflections are due on-line by 6:00 pm Sundays.

Problem Sets: Problem Sets in pre-calculus and physics give you practice with important basic concepts and calculations, as well as with problems that are generally richer and more complicated, requiring an application of concepts and skills beyond the basics. You should complete half the Problem Set by Wednesday Workshop. You should attempt all remaining problems on the Problem Set before Thursday's Problem Session. Problem Sets are due on-line by 11:59 pm Saturdays, through the on-line platforms WAMAP and WebAssign. In addition, clear and complete written solutions to Problem Sets are required in your problem set notebook, which may be checked on during the quarter.

Solution Postings and Reviews: The Solution Postings and Reviews assignment gives you an opportunity to consolidate material from the previous week and to improve your ability to produce a clear written solution that translates your private internal understanding into a public external demonstration of that understanding. In the Wednesday Workshop, your group will be assigned a problem from that week's Quiz or previous week's Problem Set and collectively author a clear solution. One member of the group will post a link to the solution at the appropriate Forum on the program web-site. The Solution Postings are due to be posted by 11:59 pm that Wednesday. Each student will then review and comment on other posted solutions; these Reviews are due by 6:00 pm Fridays.

Quizzes: There will be an in-class Quiz each Monday at 8:30. The Quiz will primarily cover material from the previous week. If you miss the Quiz due to absence, you will have the opportunity to make it up the next day at noon (immediately after Math Lab). If you are concerned about your performance on a Quiz, you can submit a Quiz Revision which will serve as the basis for a discussion between you and your faculty. Quiz Revision and Discussion occurs at noon following the Math Lab the week after the Quiz is returned to the class (e.g. the Quiz given on Week 2 Monday is returned Week 2 Wednesday. The Quiz Revision and Discussion then occurs at noon following the Week 3 Math Lab).

Exams: There will be in-class Exams in weeks 5 and 10. These exams offer you an opportunity to demonstrate what you have learned through reading, lectures, labs, homework, and other program activities.

Portfolio: Throughout the program, you will maintain a portfolio of your work consisting of all the above assignments and assessments as well as any notes or other material that reflects your work. The portfolio will be submitted at the end of week 10 and will inform faculty evaluations. It will also provide a lasting record and resource for your own future reference.

- **Self-Evaluation:** Each student is required to write and submit to faculty an evaluation of their own work and achievements in the program. We will have short evaluation writing workshops to help you through this process. Self evaluations should be printed out for inclusion in your Portfolio.