

Course Description

Math 31H

Honors Topics in Calculus II

Shahriar Shahriari

What is Honors Calculus II? Math 31H is a second semester calculus class that tries to teach you about the concepts and techniques of Calculus in a novel context. The hope is that in addition to calculus, you will have a chance to explore some other areas of mathematics. (Note that the first semester of college calculus—our Math 30—corresponds, roughly, to AP Calculus AB, while the first *two* semesters of calculus—our Math 30 and 31—correspond, roughly, to AP Calculus BC.)

Content. Calculus is a powerful theoretical and practical tool because it allows us to approximate. The purpose of this course is to get an appreciation for the beauty, fun, and nature of mathematics by focusing on the basic ideas of calculus and their relation to other areas of mathematics. The theme for the class is approximations. We will see a number of unusual topics—such as using calculus to approximate the number of primes—and we will cover major topics (transcendental functions, series, Differential equations, Taylor series) of second semester Calculus. Whereas in a traditional calculus course much time is spent on developing and perfecting certain specific skills (integrating, applying various convergence tests for series, solving special types of Differential Equations, etc.), in this course we will concentrate on a deeper understanding of concepts.

Will there be a chance to review Calculus I? This class assumes that you have had a solid one semester course in calculus (e.g., our Math 30 or AP Calculus AB) and that you are comfortable taking derivatives of straightforward functions, finding anti-derivatives using substitution, finding areas and tangent lines, and that you have seen the fundamental theorem of calculus. Even so, we will discuss the underlying ideas of first semester calculus repeatedly, and, as a result there will be the chance to review what you may have forgotten.

Are there topics in Calc II that are not covered in 31H? While the major topics of Calculus II are covered in 31H, we will spend much less time on techniques of integration.

Who should consider taking Math 31H? Math 31H is a challenging class but anyone who is ready for second semester calculus can take it. It could especially be useful for those who have had some topics of second semester calculus but are not ready to enter third semester of calculus or linear algebra. 31H will give you the chance to get ready for Math 32 or Math 60 while presenting you with some new material. This class could also be of interest to those who want to have a broader idea of what mathematics is and thus would like to see some material outside of calculus.

Should I take Math 31, Math 31S, or Math 31H? We offer three flavors of second semester calculus. They are all challenging and interesting, and all three prepare you for Math 32 or Math 60. If you want an interesting but straightforward class that continues the topics you learned in first semester calculus, then you should consider Math 31. If you are interested in the application of calculus to the life sciences and want a more applied class, then you should consider Math 31S. If you want something challenging and different, if you want to get a taste of other areas of mathematics (e.g., number theory), or if you think some topics in Math 31 will be repetitious for you, then you should consider Math 31H. Students often report that Math 31H gave them a new and different view of what mathematics is.

Should I take Math 31H or Math 32 or 60? If you have had the equivalent of AP Calculus BC and done well, then you are ready for Math 32 or Math 60. (We suggest Math 60 for those who are planning to continue taking several math classes.) If you have only had the equivalent of AP Calculus AB, then you are not yet ready for Math 32 or 60, and should consider some variant of Calc II. You could consider Math 31H, if you want to solidify your understanding of Calculus of one variable before moving on. Math 31H will give you a chance to learn some new material while getting used to the challenges of college level mathematics.

Structure. This course is structured somewhat differently from a traditional mathematics course. You are expected to take an active part in developing the mathematics. A good portion of the material that we cover will be first introduced in homework problems *before they are discussed in class*. For this reason, collaboration with your peers will be an important (and enjoyable) part of the learning process. In addition, your questions, insights, and class participation will be an invaluable component of the course, affecting both the content and the attraction of the material we cover.

What is the work load? There will be 3 homework assignments a week and each will consist of 5 problems. Some of the problems will be quite challenging but there will be ample resources to support you. When past students were asked “On average, how many hours per week, did you spend on this course outside of class?”, the median answer was 9, and fifty percent of the students reported working between 8 to 10 hours per week outside of class. (Twenty five percent reported spending between 5 and 8 hours a week, while another twenty five percent reported spending between 10 and 15 hours a week on this class.)

When is Math 31H offered next? Barring unusual circumstances, Math 31H is offered every fall at Pomona.

Text. The text for the class is

Shahriar Shahriari, *Approximately Calculus*, American Mathematical Society, 2006.