

## REAL ANALYSIS 1 MWF 9:50-10:50AM FALL 2020 ARC 219A

Instructor:	Jonathan White, <a href="mailto:jwhite@coe.edu">jwhite@coe.edu</a>
Chair:	Gavin Cross, <a href="mailto:gcross@coe.edu">gcross@coe.edu</a>
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Office:	Stuart 316
Office Hours:	10-11am Tuesdays and Thursdays (link on Web Page), and by appointment
Office Phone:	399-8280
Texts:	<i>A Friendly Introduction to Analysis, Single and Multivariable</i> , 2 <sup>nd</sup> Edition, by Witold Kosmala, Prentice-Hall; <i>A Tour of the Calculus</i> , by David Berlinski.
Problem Sets:	Problem Sets will be given throughout the term to supplement class work. Combined these will be worth 200 points.
Quizzes:	Frequent small quizzes will be given without warning, worth 50 points altogether.
Math Culture Points:	Math Culture Points will constitute 50 points. These will be earned through participation in various activities outside of class, as detailed elsewhere.
Exams:	There will be two exams during the course of the semester, administered during class time. The dates of these are indicated in the schedule on the back side of this sheet. These exams will be worth 100 points each.  The final exam will be held during finals week at the date and time indicated on the back side of this sheet. The final will be worth 200 points.
Grading:	Grading will approximately follow a [92.0%, $\infty$ ) $\rightarrow$ A, [90%, 92%) $\rightarrow$ A-, [87%, 90%) $\rightarrow$ B+, [82%, 87%) $\rightarrow$ B, [80%, 82%) $\rightarrow$ B-, [77%, 80%) $\rightarrow$ C+, [72%, 77%) $\rightarrow$ C, [70%, 72%) $\rightarrow$ C-, [67%, 70%) $\rightarrow$ D+, [62%, 67%) $\rightarrow$ D, [60%, 62%) $\rightarrow$ D-, ( $-\infty$ , 60%) $\rightarrow$ F scale. Current grade information will be available online via Moodle.
Late Work:	For the sake of fairness to those who follow the schedule, makeups for exams will be allowed only under extenuating circumstances, with documentation and advance notice when humanly possible. Problem Sets lose 20% of the points possible for each portion of a day late, and late quizzes will only be accepted under extenuating circumstances.

*“And what are these fluxions? The velocities of evanescent increments. And what are these same evanescent increments? They are neither finite quantities, nor quantities infinitely small, nor yet nothing. May we not call them ghosts of departed quantities?”*  
-Bishop George Berkeley, 1685-1753

Real Analysis is in many ways a dramatically different course than anything which precedes it in the mathematics curriculum. In some regards, students finally get a chance to see the sorts of things that professional mathematicians deal with -- but at the same time, many of these underpinnings are beneath notice once they've been properly laid. The simplest thing that can safely be said is that there are genuinely troubling issues left unaddressed by the undergraduate calculus sequence, and they must be dealt with before moving on.

It is also important to note at this point that the demands on students become qualitatively different in this course than in its prerequisites. Learning strategies which have succeeded in previous classes will not necessarily suffice at this level. If at some point these challenges or frustrations get too bad, I strongly encourage you to see me for extra explanation -- don't wait until you're overwhelmed. I'm here to help.

## Tentative Schedule

	Wednesday 8/26 §1.7-8 Real Numbers & Their Properties	Friday 8/28 §1.9 Review
Monday 8/31 §2.1 Convergence	Wednesday 9/2 §2.2 Limit Theorems	Friday 9/11 §2.3 Infinite Limits
Monday 9/7 No Class – Labor Day	Wednesday 9/9 §2.4 Monotone Sequences	Friday 9/7 §2.5 Cauchy Sequences
Monday 9/14 §2.5 Cauchy Sequences	Wednesday 9/16 §2.6 Subsequences	Friday 9/18 §2.7 Review
Monday 9/21 §3.1 Limit at Infinity	Wednesday 9/23 §3.2 Limit at a Real Number	Friday 9/25 §3.3 One-Sided Limits
Monday 9/28 §3.4 Review	Wednesday 9/30 <b>Exam 1</b>	Friday 10/2 §4.1 Continuity
Monday 10/5 §4.1 Continuity	Wednesday 10/7 §4.2 Discontinuity	Friday 10/9 §4.3 Properties of Continuous Functions
Monday 10/12 §4.3 Properties of Continuous Functions	Wednesday 10/14 §4.4 Uniform Continuity	Friday 10/16 No Class – Fall Break
Monday 10/19 §4.5 Review	Wednesday 10/21 §4.6 Compactness	Friday 10/23 §5.1 Derivatives
Monday 10/26 §5.2 Properties of Differentiable Func.	Wednesday 10/28 §5.3 Mean Value Theorems	Friday 10/30 §5.4 Higher Derivatives
Monday 11/2 §5.5 L'Hôpital's Rules	Wednesday 11/4 §5.6 Review	Friday 11/6 <b>Exam 2</b>
Monday 11/9 §6.1 Riemann Integrals	Wednesday 11/11 §6.1 Riemann Integrals	Friday 11/13 §6.2 Integrable Functions
Monday 11/16 §6.2 Integrable Functions	Wednesday 11/18 §6.3 Properties of Riemann Integrals	Friday 11/20 §6.4 Integration and Differentiation
Monday 11/23 §6.5 Improper Integrals	Wednesday 11/25 No Class – Thanksgiving	Friday 11/27 No Class – Thanksgiving
Monday 11/30 Dedekind Cuts		
<b>Final Exam – 10:30am Friday, 12/4</b>		

Any students with disabilities which might affect their performance in this class should contact me as soon as possible to arrange accommodations.

The faculty has adopted a policy on academic integrity. It is your responsibility to understand and follow it.

Diversity, in all its forms, is valuable.

# Learning Outcomes

By the end of this class each student should be able to demonstrate:

- understanding of the real numbers as a set with axiomatically developed properties.
- rigorous understanding of limits of sequences of real numbers and the standard associated theorems.
- rigorous understanding of limits of real functions and the standard associated theorems.
- rigorous understanding of continuity of real functions and the standard associated theorems.
- rigorous understanding of derivatives of real functions and the standard associated theorems.
- rigorous understanding of Riemann integrals of real functions and the standard associated theorems.

The Provost has mandated that the material below this line appear on all syllabi:

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## Mission Statement:

Coe College is a national, residential liberal arts college offering a broad array of programs in the arts, sciences, and professions. Our mission is to prepare students for meaningful lives and fulfilling careers in a diverse, interconnected world. Coe's success will be judged by the success of our graduates.

## Academic Integrity

At Coe College, we expect academic integrity of all members of our community. Academic integrity assumes honesty about the nature of one's work in all situations. Such honesty is at the heart of the educational enterprise and is a precondition for intellectual growth. Academic dishonesty is the willful attempt to misrepresent one's work, cheat, plagiarize, or impede other students' academic progress. Academic dishonesty interferes with the mission of the College and will be treated with the utmost seriousness as a violation of community standards. Please refer to the Coe College Academic Catalog for complete information regarding Academic Integrity: [www.coe.edu/academics/academic-resources/provosts-office/academic-integrity-policy](http://www.coe.edu/academics/academic-resources/provosts-office/academic-integrity-policy)

## FERPA

Students should be aware of their rights regarding the privacy of their educational records. Detailed information about your rights can be found under the FERPA (Family Educational Rights and Privacy Act of 1974) section in the Academic Catalog and online here: <https://www.coe.edu/academics/academic-resources/registrar/ferpa>  
In line with FERPA restrictions, students should be aware that an instructor cannot publicly post grades by student name, institutional student identification number, or social security number without first having obtained students' written permission.

## The Definition of a Course Credit & Expected Workload

One course credit at Coe College constitutes 180 hours' worth of student work over the course of the term. "The Department of Education has defined one hour to be 50 minutes, so 150 60-minute hours is equivalent to 180 50-minute hours." This figure includes both the time spent in class and out of class completing course work. In other words, students are expected to devote a considerable amount of time outside of class to this course. For courses that meet in a standard MWF or T-Th slot, students should be expected to work seven hours a week outside of the three hours in class. Even with the 13.3 week term, the same number of contact hours (in person or remote) will be achieved with longer class meetings. Contact hours are per credit and do not change with modality. A credit is a credit.

## Students with Disabilities: Request for Accommodation

Coe College, in compliance with equal access laws, will make reasonable accommodations for persons with ADA

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qualifying disabilities. If you have a hidden or visible disability, or believe you may have a disability that affects your learning and may require classroom or test accommodations I encourage you to visit my office during office hours (in person or remote) or email to schedule an appointment at a mutually suitable time so we can discuss ways to support your learning within our class. Additionally, in order to receive accommodations in higher education, students must communicate with Laura Hayes, the Accessibility Services Coordinator, to verify the disability and establish appropriate accommodations. The Accessibility Services Office is located in the Learning Commons in the lower level of Stewart Memorial Library (near the Testing Center desk). This office is responsible for coordinating accommodations and services for students with disabilities. Please call 319-399-8844 or email [accessibility@coe.edu](mailto:accessibility@coe.edu) to schedule an appointment.

### **Reporting of Sexual Assault or Misconduct**

As an instructor, one of my responsibilities is to help create a safe learning environment on our campus. I also have a mandatory reporting responsibility related to my role as a faculty member. It is my goal that you feel able to share information related to your life experiences in classroom discussions, in your written work, and in any one-on-one meetings. I will keep the information you share with me private to the greatest extent possible. However, I am required to share information regarding sexual misconduct or students who may be in danger to themselves or to others. Students may speak to someone confidentially by contacting Student Life at 319-399-8843 or emailing [titleix@coe.edu](mailto:titleix@coe.edu), Safety, and Security at 319-399-8888, Emily Barnard (college counselor) at 319-399-8843, or visit Coe's Title IX website for more information.

Face coverings will be required in all indoor public spaces, which includes the classrooms, labs, and between classes. Any students without a face covering will be asked to leave the classroom or lab. " Anyone who is not compliant with the classroom and lab protocols will be asked to leave the classroom until compliance can be maintained. If a student refuses to follow college guidelines upon request, the faculty member should cancel class and contact the Provost immediately. Refusal to comply with classroom protocols will be considered as deliberately impeding other students' work and will be addressed by the Provost's Office."