# Phil 373: Introduction to the Philosophy of Mathematics

## Basic Information

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| Office Hours: | Wednesday 3:30-5:30 and by appointment |
| Course Website: | http://www.mayowilson.org/Teaching/Winter_2017/PhilMath.htm<br>http://canvas.uw.edu |

## Course Description

Galileo once claimed, "The universe cannot be read until we have learned the language and become familiar with the characters in which it is written. It is written in mathematical language, and the letters are triangles, circles and other geometrical figures, without which means it is humanly impossible to comprehend a single word. Without these, one is wandering about in a dark labyrinth." Galileo's views about the importance of mathematics were/are not unique. Since Ancient Greece, philosophers have argued that mathematics is the paradigm of knowledge. Today, almost every science employs mathematics, as mathematical techniques are often thought to embody rigor and objectivity.

In light of these facts, it is perhaps surprising that, until the middle of the 20th century, the foundations of mathematics were hotly contested. Many eminent mathematicians of the nineteenth and twentieth centuries (e.g., Hilbert, Cauchy, Weierstraß, Dedekind, etc.) believed that accepted proofs of even elementary theorems from geometry and calculus lacked appropriate logical rigor. This perception led to the "search for rigor" in nineteenth century mathematics and the so-called "crisis" in the foundations of mathematics at the beginning of the twentieth century. This course is an historical introduction to the philosophical questions that prompted this search for rigor and the resulting foundational crisis.

We will focus on one central question: to what degree are mathematical theorems justified by rational insight, experience, purely symbolic computations, or some combination of the three? We will trace answers to this question from Ancient Greece until Kant's time, and we will pay close attention to how answers to this question are related to mathematical developments concerning the relationship between arithmetic and geometry.

The course presupposes no mathematical background, except high-school algebra and geometry.

## Course Goals

The course has three central goals. First, by the end of the semester, students should be able to state several key philosophical questions that prompted a search for a "foundation" for mathematics in the 19th and 20th centuries. Second, students should be able to explain how changes in mathematical practice changed philosophical theorizing (and vice versa). In particular, students should be able to identify features of Ancient Greek mathematical practice that led to central epistemological problems in modern philosophy about the justificatory roles of reason, sense perception, and symbolic computation. Finally, students should be able to reconstruct, critique, and develop epistemological arguments about the foundations of mathematics, and they should be able to communicate those arguments orally and in writing that is clear, brief, and precise.

## Requirements

Philosophical thinking is a skill, not unlike playing the piano, riding a bike, or dancing. Learning a new skill requires practice, and the best way to practice philosophical thinking is to write and engage

in spirited (but polite) debates with other philosophers. Thus, the central requirement of this course is to write two papers in which you summarize an argument from the readings and defend it from potential objections. More details about the topics of the two papers can be found on the course website.

Additionally, before each class period, I will ask you to answer two to five short questions about the readings. Most of the questions require only one sentence to answer, and none require more than a paragraph. Please bring both the assigned readings and your answers with you to class. Some students view frequent assignments/assessments as "busy work" or as an instructor's attempt to gauge which students are working hardest. That is is not my intention at all. The philosophy of mathematics is a complex subject, and consequently, many of the assigned readings are somewhat difficult. When faced with hard-to-understand texts, it is easy to become discouraged and to give up. One of my central duties, as an instructor, is to ensure that you do not give up when concepts and/or arguments are initially difficult to understand. The purpose of the nightly questions is threefold: (i) to encourage you to read the assigned texts closely and actively, (ii) to prepare you for class discussions in which we will clarify and build upon the readings, and (iii) to provide *me* with feedback about which concepts are most difficult for students to understand.

Finally, you will not be able to understand the course material without attending class. I teach some courses (e.g., introductory logic) in which I recognize that, for some very bright, motivated and hard-working students, attending class is not always necessary. This is not such a course. The assigned readings are extremely difficult for a number of reasons, and without class discussion and lecture, you will likely learn very little. To encourage you to attend and to make sure you are active in class discussions, I will ask you a question at the end of every class about the material that has been covered that day, and I will give you fifteen minutes to write a short response to said question.

## My Grading "Philosophy"

Assigning grades is an important but extremely difficult part of my job as an instructor. Before explaining how you will be assessed, I will describe the purpose of grades in my course. Many instructors attempt to use grades to perform (at least) four functions: (i) to provide feedback to students about how much they have learned, (ii) to provide feedback to students about how well they are performing in relation to other students in the class, (iii) to give incentives to students to learn particular skills, (iv) to record students' performance for future instructors, graduate schools, potential employers.

A moment's reflection shows that grades cannot perform all of four functions simultaneously. For example, if every student in a mathematics course earns a perfect score on an exam, then by the first criterion, each student ought to receive an "A". Why? An "A" grade accurately reflects how much students have learned. On the other hand, if every student earns a perfect score, then each student's performance is "average" for the class. If an instructor assigns "average" work a "C" grade and he or she thinks that grades ought to indicate the relative performance of students (i.e. fulfill the second function), then every student in the class would earn a "C." Similar reasoning shows the other criteria also conflict with one another.

For these reasons and others, I use grades only for the first and fourth purposes, namely, to provide you (and others) with feedback about how well you have learned the skills and facts taught in the course. Very roughly, a final grade of an"A" grade indicates that your knowledge of the course material and your performance of the skills taught in the course are both excellent; a "B" grade indicates they very good; "C" indicates that you have acquired a general understanding of the material and skills, but you have missed some finer points; "D" indicates that your work contains some very serious errors and misunderstandings. I fail students only when their work contains very serious errors and misunderstandings throughout.

## Grading

### Assignment Grades

I use rubrics when assigning you grades on more substantial assignments (e.g., papers and presentations). Rubrics contain detailed descriptions of which skills you are performing well and which are in need of improvement. I encourage you to look at the rubrics before you write your papers so that you know exactly how you will be assessed. Even better, find a partner and grade each other's papers using the provided rubrics. Doing so gives you experience evaluating philosophical work and will improve your own writing.

I do not regrade assignments, but I would be happy to clarify why you received the grade that you did.

### Final Grades

Your final grade (as a percentage) is a weighted average, which is calculated using the following weights:

- Nightly Reading Assignments (weighted evenly) - 25%
- Responses to In-Class Questions - 10%
- Participation - 5%
- First Paper (about 1200-1500 words; limit of 1,500 words) – 30%
- Second Paper (about 1200-1500 words; limit of 1,500 words) – 30%

It is necessary to write all three papers in order to pass the course. Your final grade will be converted to a four point scale using the following equation:

$$\text{Four Point Scale} = \frac{\text{Percentage}}{10} - 5.5$$

For example, if your final percentage is 90%, then your final grade will be $3.5 = \frac{90}{10} - 5.5$.

## Course Mechanics

### Submitting assignments

Reading assignments are due at the beginning of class. You should bring a typed, hard copy of your assignment to class; your answers should not exceed the front side of one page. At the end of class, I will ask you to turn over your reading assignment and respond to a question about the material from class. You can write your response in pencil or pen.

All papers should be submitted electronically via Canvas. Please do not email me your papers unless you already have tried to upload them via Canvas. When a class exceeds even a small number of students (e.g., ten), it is difficult for an instructor to organize and maintain a record of students' work if it is submitted via email.

### Late assignments and extensions

I do not accept late work. Here's why.

With respect to reading assignments, I do not grant extensions because the purpose of these assignments is to ensure that you are ready to participate in class. Clearly, completing the assignment *after* class does not prepare you *before* class. Submitting an incomplete reading assignment is far better than submitting nothing for both you as a student and me as an instructor: (1) you get partial credit for partial work and (2) the fact that your assignment is incomplete provides me with information about what you did and did not understand from the assigned readings.

I also do not accept late work on papers, unless you experience some sort of life-changing event. Such "life-changing" events include (but are not limited to) sudden surgery, the death or sickness of a family member, financial emergencies, house fires, etc. If you need to ask for an extension on a paper, however, you should talk to me about why, and you should bring documentation (e.g., a note from a psychiatrist, or a plane ticket verifying that you flew home for a funeral) explaining your circumstances. I recognize that you are taking several courses and that there are many important events in your life that trump writing a paper for a philosophy course. But you have plenty of time to complete the assignments for this class (as paper topics are available from the first day of class), and in the absence of compelling personal reasons, you should not need to request an extension on an assignment. One aspect of achieving success in college is learning how to manage your own time.

If you are not granted an extension, then five percentage points will be deducted from your final grade (on the paper) for every twelve hour period that elapses between the due date and the time at which you turn in your paper.

**Computer use**

I highly encourage you to leave all computers at home. Instead, I suggest you bring a notebook, a pen or pencil, and hard copies of the assigned readings. Extensive empirical evidence indicates that students who use computers learn less for two reasons. First, students who use computers often attempt to "multi-task" (e.g., take notes, read, and browse the internet simultaneously), and extensive research shows that (i) no one can multi-task effectively, and (ii) multi-tasking hinders learning. Further, research shows that even those students who use computers exclusively for note-taking still learn more when they take notes by hand [1].

Nonetheless, there is one compelling reason for using a computer in my class. Textbooks are expensive, and many of you do not have several hundred dollars to spend on books each quarter. That's why I provide you with electronic copies of all assigned readings. For this reason, many of you may wish to bring a laptop to class so that you can refer to the readings. I understand, but if you have the ability to print copies of the readings , I ask you to consider how small the price of printing is in comparison to its educational value.

So here is my policy on computers in the classroom. You may not use phones or any other hand-held devices during class. You may bring a laptop to class, but it can only be used for note-taking and/or referring to the readings assigned for the day. If you bring a computer, turn off your Wi-Fi and disconnect from all networks immediately upon entering the classroom. If I (or any other student) sees that you are browsing the internet, instant messaging, playing video games, or some other non-academic activity during class, you forfeit the right to use a computer in the classroom. When you browse the internet in class, you harm not only your own education but also that of those students around you.

STUDENTS WITH DISABILITIES

If you have a disability that may affect the quality of or timeliness with which your work is submitted, please visit the office of disabilities resources for students (DRS) at the beginning of the semester and have them send me appropriate suggestions concerning how to modify course requirements. I want every student to succeed, and I am more than happy to adjust the course so that it suits you.

The DRS's website is listed in the important websites section at the end of this document.

## Academic Integrity

Almost no student plans to cheat or plagiarize at the beginning of the semester. The two most common reasons for plagiarism are (1) ignorance of what constitutes plagiarism and (2) lack of planning. In other words, students plagiarize most frequently because they either do not know what "plagiarism" means or they run out of time (and think that copying another person's paper is a quick fix). Here is how you can make sure you do not plagiarize.

First, read the university's definition of "plagiarism", which can be found in the list of websites below. If you know the university's definition of "plagiarism", then you are less likely to plagiarize. Second, ask for extensions when you need them, and come talk to me if you need extra time. I know what it is like to have too much to do and not enough time. Let's try to find a solution together.

If, despite your best intentions and my advice, you find yourself contemplating cheating in the future, you should know two things. First, the penalties are extremely high, and second, you will almost certainly get caught. Why are the penalties high? I am required to report your conduct to the Dean of Arts and Sciences. You will then attend an embarrassing and time-consuming trial-like procedure in which the Committee on Academic Conduct will evaluate your conduct and issue some form of punishment. Some penalties are small (e.g., warning or probation), but the committee may also suspend or dismiss you from the university. In addition to institutional penalties, I have the following policy: students who plagiarize once will have their final GPA multiplied by $\frac{2}{3}$ (e.g., a 3.9 final grade will become a 2.6); students who are caught cheating twice will receive a zero final grade.

## Resources and Websites

You are attending a great university with many resources that allow you to succeed. Here are some suggested resources.

| **Resource** | **Website** |
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| Philosophy Writing Center | http://www.phil.washington.edu/resources/writing-center |
| Clue Writing Center | http://depts.washington.edu/aspuw/develop/writing-center/ |
| Disability Resource Services | http://depts.washington.edu/uwdrs/ |
| Definition of Plagiarism | https://depts.washington.edu/grading/pdf/AcademicResponsibility.pdf |

## Miscellenea

Additional information about academic integrity, obtaining incomplete grades, safe campus, appealing your grade, and more can be found on the syllabus attachment document on the Canvas website.

## References

[1] P. A. Mueller and D. M. Oppenheimer. "The Pen Is Mightier Than the Keyboard Advantages of Longhand Over Laptop Note Taking". In: *Psychological Science* (Apr. 2014), pp. 1159–1168.