CALCULUS AND DIFFERENTIAL EQUATIONS

Lecture 0: Upper and Lower bound, 9/1/2021

Administrative

1.1. I'm Oliver Knill (Call me "Oliver"). knill@math.harvard.edu. I'm in 432 Science Center. Our section is 9-10:15 am in Northwest B108. You can find about me on my website. I'm in interested in all kind of math. One of the topics is calculus without limits. I have office hours at Tu/Th 5-6 PM in 432. There is no appointment needed for that and you can stay as long as you need. Here are a few points:

- The course assistants for this section are
  Brandon Calderon, (brandoncalderon@college.harvard.edu) and
  Emmanuel Ramirez (eramirez@college.harvard.edu)
- The warm-up series 0 is due on Friday via Gradescope.
- Ask questions if something is not clear.
- Stay on the ball with the homework. Check the course website regularly.
- We meet one to one in the first two weeks. (See sheet handed out).
- The math question center MQC runs Sunday to Thursday Sun-Thu 7:30-10:30 in B10. On Monday, there is one hour less.
- Some problem sessions will be announced.
- Make use of my resources. You can also arrange time outside OH. Before or after class are good times.

About the course

1.2. Calculus deals with sums and differences. Together with the notion of limit one can get to **infinite sums**, **integrals** and **differential equations**. These are the three topics in this course.

Introduction

1.3. Why not break the ice with some math. Each of you will get a card with some math. Each of you will also be associated with some mathematician. I want to hear from each their name and birthday (only month and day) and of a famous person which matches.

1.4. I prepared index cards with integrals. Each of you will have a specific integral which you own. HW 0 also gives some valuable preparation for the techniques teste.

Lower and upper bound

1.5. When estimating **distances** there is a simple method to get quite accurate results. It involves the concept of **lower and upper bound**. We will practice this with length, area and if time also with volume.

An experiment

1.6. We will measure the area of a leaf by giving upper and lower bounds.

On the radar

1.7. As a preview. You should have the integration proficiency test in mind. We will come back to it on Friday. In part a) You will be asked to cover 5-6 integration problems from a list of 80 problems. In part b) you will be asked to solve basic pre-calculus questions. There will be a retest later in the fall for whose who do poorly.

- Integration by parts
- Substitution
- Partial fractions

1.8.

- The area of an iceberg QRD problem is due 9/10.
- Techniques of integration test Wednesday 9/15 6-7:30.

Figure 1. A bee enjoying the beauty of symmetry and math.