

# Math 10850: Honors Calculus I, Fall 2020

## Homework 1

I want to emphasize that all your solutions should be written out in English prose using complete sentences and correct grammar. Strive for precision, and do not simply turn in your scratchwork!!! If you feel like this problem set is too short, don't worry: I promise that future ones will be much longer. The purpose of this short initial problem set is to provide a test of the procedure we will use to collect homework in this socially-distanced world.

1. Fill out the "Beginning of the semester survey".
2. Fill out the "Office hour availability survey".
3. (a) Give examples of three sets  $A$  and  $B$  and  $C$  (I don't care what they are sets of!) such that the following hold:

$$A \cap B \neq \emptyset, A \cap C \neq \emptyset, B \cap C \neq \emptyset, A \cap B \cap C = \emptyset.$$

- (b) Generalize part (a) and construct for each  $n \geq 2$  sets  $A_1, \dots, A_n$  such that all intersections of  $(n - 1)$  of the  $A_i$  are nonempty, but  $A_1 \cap \dots \cap A_n = \emptyset$ .
4. For the following two problems, your proof should be modeled on the proof given in class that  $A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$ , and has two parts: you should first prove that everything that lies in the left-hand-side lies in the right-hand-side, and then prove that everything that lies in the right-hand-side lies in the left-hand-side.
  - (a) Prove that  $A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$ .
  - (b) Prove that  $A \setminus (B \cup C) = (A \setminus B) \cap (A \setminus C)$ .
5. **Extra Credit:** Suppose I am given 501 numbers lying between 1 and 1000. Show that there must be two of them with no common factor. For instance, 15 and 9 wouldn't work (they share a common factor of 3), but 15 and 8 would work.