MATH1101 – Spring 2022
Intro Lab: Groupwork
Thursday, January 20, 2022

Group work guidelines:

- Work in groups of 3-4 people on the problems below.
- You do not need to work on the problems in order. You may wish to start with problems that seem more familiar, or you may opt to work first on problems that seem harder and present more of a challenge. The choice is yours!
- **This week, the group work problems on this page and the next are not being collected this week.** In subsequent weeks, they will be and more directions will be given.

1. **Icebreaker** Write down the names and contact information (email) for the other people in your group. For future labs, you will need to know this information to compile your solutions and submit them on Gradescope. **Your answer for this problem should be the names and contact information for all group members.**

   What are three things ALL members of your group share in common[1]? What are three areas in which you are all unique or different?

2. **Setting the Stage**

   Discuss the following questions with your group. You may want to take notes; you will be asked to write up your ideas from this discussion in the homework.[2]

   - Why are you interested in taking this class? What do you hope to get out of it?
   - How does a person learn something new? How do you learn something new?
   - What is the value of making mistakes in the learning process (for math and in general)? Give an example.

3. **Group Roles**

   Collaborating productively with others on math problems and communicating about math are two goals for the course. To support productive group work, we're asking you to use group roles for the first month or so, after which we'll adjust as needed. These roles help people learn to work together in a way that everyone contributes.

   Read the roles briefly. Then for each problem below, select a different role (or multiple roles) from the following. Roles should rotate throughout the group for each problem.

   - facilitator: Make sure that the task is clear to everyone, that the group is working together towards the agreed goals, and that everyone is participating and has their ideas heard.
   - recorder/reporter: Make sure important ideas and results are recorded. Record strategies and methods as well as solutions, and be ready to share the group's mathematical journey. Make sure that the team is ready to report at the end.
   - understanding coordinator: Make sure that calculations are checked and mathematical reasoning is justified. Make sure the group is making connections between ideas.
   - resource manager: Make sure everyone has a useful task to work on, and that they have the tools and information they need to complete the task. This role is the person who reaches out to the instructor if there is a group question.

   (Modified from the roles here: https://nrich.maths.org/7908.)

[1] Try to find something less obvious than being in this class together!!
[2] Problems modified from https://danaernst.com/setting-the-stage/

4. Applications of Riemann Sums

A new factory wants to maintain CO_2 emissions of no more than 20,000 lbs a week. In your role as environmental engineer, you are monitoring the factory (which operates 24 hours a day, seven days a week) to estimate the total emissions over a one-week period. Below is a table of data[3] where $r(t)$ is pounds of CO_2 per hour and t is time measured in hours from 8 am on Monday morning.

Day/Time	Mon 8 am	Tues 7 am	Wed 8 am	Thurs 9 am	Fri 8:30 am	Sun 8 am
t	0	23	48	73	96.5	144
$r(t)$	131	135	120	150	127	130

(a) Use this data to estimate the total emissions during this week (from 8 am Monday to 8 am Monday). (There is more than one way.)

Include units with your computations, and explain your reasoning.

(b) Make a rough sketch of a *possible* graph of $r(t)$ as a function of t. How does your estimate relate to the graph? (Don't worry about it being perfectly to scale.)

(c) Can you tell if your estimate is an over- or underestimate for the total emissions? Are you making any assumptions? What other ways could you estimate that could be more precise or rely on different assumptions?

(d) Can you definitely conclude whether the factory is emitting over 20,000 lbs? Why or why not?

(e) Suppose you learn that the factory shut down briefly on Wed at noon until Thurs at midnight. Does this information affect your estimate and if so, how? Explain your reasoning.

(f) How does the method you used in this problem relate to the ideas from the first class about distance, speed and time?

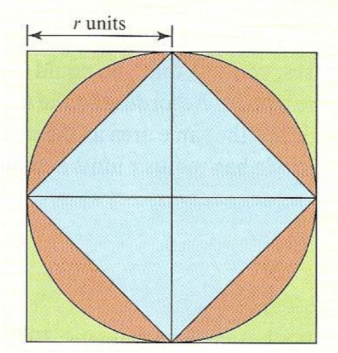
5. Estimating π

Before you begin, select and record your roles for this problem.

Estimating the area of a circle is a problem that has inspired humans across cultures.

- Pretend you don't know the value of π at all, or the area of a circle formula. Use the picture below and geometry to get over- and underestimates for the area of a circle of radius r. (Don't use the area of a circle formula - you're just getting estimates.)
- Use your estimates in the case that $r = 1$ to find an estimate for the area of a circle of radius 1.

  We know the exact value of this area is the number π. How close are your estimates?
- How you might improve these estimates using similar area computations? Explain (but do not calculate). Include pictures with your explanation. How does this relate to the ideas from the first class?



[3]These numbers were created based off the assumption that the factory is using 100 kWh of electricity per hour and that the average electricity source emits 1.306 lbs of CO_2 per kWh, according to http://www.carbonfund.org/site/pages/carbon_calculators/category/Assumptions.