MATH 303
Fall 2024

Syllabus & Linear Systems

Week 1, Session 1

1 SI Logistics

- By now, you should hopefully be in the Math 303 SI companion course. If you're not, please let me know via email or Canvas message!
- Fill out the when2meet survey to let me know when you're free for SI sessions and office hours beginning next week!
- Here's a guide to AsciiMath syntax that you may want to bookmark. To enter "math mode" in a MyOpenMath window (e.g. on quizzes), just surround some math text with backticks. For example, `` `[[a,b],[c,d]]` `` generates a matrix $\begin{bmatrix} a & b \\ c & d \end{bmatrix}$.
- To my knowledge, discussion posts use Latex instead of AsciiMath, so the above should hopefully only be relevant to quizzes/exams.

2 Opener/Intro Activity

Before we start the session, let's get to know each other! As we go around the room, share some or all of the following:

1. Name, where you're from
2. Major, how long you've been at IU, and your current career/academic goal
3. Your favorite class you've taken up to this point
4. Would you rather live in the city, suburbs, or country? How come?
5. What's a favorite song or artist you've discovered recently?

3 Syllabus Overview

3.1 Homework

- For homeworks, you can retry problems twice with the answer being shown on your third attempt.
- If you're unable to get the problem correct even with your retries, you can select "Try a similar problem" to get a new version of the problem to solve. If you're able to complete this new problem, you will still get full credit! This means you can get full credit on every homework as long as you put in the work.
- Homework is due every Saturday night at 11:59 PM Eastern.

3.2 Quizzes

- Quizzes require submitting an answer and an explanation. 50% credit is given for the correct answer, 50% for the explanation.
- There will be a box under each quiz problem where you can type your explanation using AsciiMath.
- For the accuracy part, you will generally have 3 attempts per question with a 30% penalty for each incorrect attempt.
- Quizzes have a 3-hour time limit beginning when you start them, and are due every Monday night at 11:59 PM Eastern.
- **TIP:** You generally have plenty of time on quizzes. Use the extra time to check your work before submitting to make sure you avoid careless mistakes that cost you 30% each!

3.3 Exams

- There will be two exams, a midterm and a final. Both will have a 4-hour time limit and be due on Fridays at 11:59 PM Eastern.
- There won't be quizzes on exam weeks.
- The exams will be identical to quizzes in format and grading.
- Prior to each exam, there will be a special exam review assignment on top of the normal work for the week. This is *graded* and generally very helpful to prepare for the exams, so make sure to do them!

3.4 Discussion Boards

- To get full credit on discussion boards, you must contribute (post or reply meaningfully) at least 5 times each week.
- The "Posts on Discussion Board" assignment itself is ungraded; it's just there to provide the necessary info for that week's discussion.

- Posts 1 and 2 will be solving your two problems from the "Posts on Discussion Board" assignment for the week. These problems will be different for everyone!
- Post 3 will consist of finding a video related to the week's topics on YouTube and embedding it in a discussion post. Make sure no one else has already chosen your video (you may not get credit for this post if so)!
- Posts 4 and 5 should be meaningful responses to a classmate's post. Some ideas for meaningful replies are correcting a mistake in their solution, offering an alternative solution method, or expanding on a topic covered by their problem.

4 System of Equations, Geometry

4.1 Use the Desmos Graphing Calculator to plot the following two-variable linear systems, and describe their solutions.

1. $\begin{cases} x + y = 3 \\ y - x = 5 \end{cases}$
2. $\begin{cases} y = 3x - 5 \\ 3y - 9x = -5 \end{cases}$
3. $\begin{cases} x + y = 3 \\ y - x = 5 \\ x = -1 \\ y + 4x = 0 \end{cases}$
4. $\begin{cases} y - 2x = -4 \\ y = x - 2 \\ 2y = 2x - 4 \\ x + y = 1 \end{cases}$

4.2 Suppose you have a system of 4 equations in two variables. For each number of solutions below, describe or draw how a system with that many solutions may look geometrically:

1. No solution
2. A unique solution
3. An infinite number of solutions

5 System of Equations, Algebraic Procedures

5.1 Recall the definitions of homogeneous systems, consistent systems, and inconsistent systems. Determine whether the following statements are true or false and explain why.

1. Homogeneous linear systems are always consistent.
2. A system of linear equations can have exactly three solutions.
3. A system of linear equations can have a solution which does not satisfy all conditions of the system.
4. A system of more than two linear equations in two variables cannot be consistent.
5. A two-variable homogeneous system may have solutions besides $(0, 0)$.

5.2 Use elementary row operations and back substitution to solve the following systems (or determine it has no solutions):

1. $\begin{cases} 3x + 2y = 6 \\ 2x + 3y = 9 \end{cases}$
2. $\begin{cases} 4x - 3y = 10 \\ \frac{1}{2}x - y = 0 \end{cases}$
3. $\begin{cases} 3x + y - z = 9 \\ 2x - 2y + z = -3 \\ x + y + z = 7 \end{cases}$
4. $\begin{cases} 4x - 3y = 10 \\ 8x - 6y = 20 \end{cases}$
5. $\begin{cases} 6x - 3y = 2 \\ 3x - \frac{3}{2}y = 3 \end{cases}$
6. $\begin{cases} 12x - 9y = 3 \\ 12x + y = 0 \\ x + y = 5 \end{cases}$

6 Closing - Informal Quiz

6.1 Determine whether the following statements are true or false:

1. A linear system cannot have more than three variables.
2. A linear system in two variables and consisting of 4 equations can be consistent.
3. Inverting the sign on each term of a linear equation is a valid row operation.
4. $(0, 0)$ is always a solution of a two-variable homogeneous linear system.

6.2 Is the following system of equations a linear system? Why or why not?

$$\begin{cases} 3x^2 + 2y^2 = 4 \\ 4x + 3y = -1 \end{cases}$$

6.3 Suppose a three-variable linear homogeneous system is known to have additional solution(s) beyond $(0, 0, 0)$. How many solutions to the system will there be?