MATH 110, Fall 2013
Tutorial #3
September 25, 2013

Today's main problems

1. Consider the system

$$\begin{aligned} x - 3y - 5z &= 0 \\ y + z &= 3. \end{aligned}$$

   (a) Row reduce the corresponding augmented matrix.

   (b) Identify the solution as a point, line, or plane.

   (c) Write the solution in vector form.

2. Consider the system

$$\begin{aligned} x + hy &= 2 \\ 4x + 8y &= k, \end{aligned}$$

   which has two unknown quantities: h, k. Find values of h and k so that the system has

   (a) no solution

   (b) a unique solution

   (c) many solutions

Further questions

3. Consider the system

$$\begin{aligned} x - 2y - z &= 0 \\ -2x + 4y + 5z &= 3 \\ 3x - 6y - 6z &= 2. \end{aligned}$$

   (a) Row reduce the corresponding augmented matrix.

   (b) Identify the solution as a point, line, or plane, if it exists.

   (c) Write the solution in vector form, if it exists.

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Challenge questions

4. Sketch an example of a system in $\mathbb{R}^2$ that has no solution.

5. Sketch an example of a system in $\mathbb{R}^3$ that has no solution.

6. P_1, P_2, and P_3 are planes in $\mathbb{R}^3$. The normal vectors for P_1 and P_2 are $\vec{n}_1 = \begin{bmatrix} 1 \\ 1 \\ 2 \end{bmatrix}$ and $\vec{n}_2 = \begin{bmatrix} -1 \\ 1 \\ 2 \end{bmatrix}$, and the normal vector for P_3 is $\vec{n}_3$ which we won't specify exactly. Further, P_1 and P_2 contain the origin and P_3 passes through the point $(1, 1, 2)$ and does not contain the origin.

   (a) Is the point $p = (0, -4, 2)$ in the intersection of P_1 and P_2?

   (b) If $\vec{n}_3 \cdot p = 2.7$, do P_1, P_2, and P_3 all intersect?

   (c) If $\vec{n}_3 \cdot p = 0$, do P_1, P_2, and P_3 all intersect?

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Tutorial #3. Instructions for TAs

Objectives

There are some very computational tools that we lean on a lot in Linear Algebra. One of these tools is solving systems using row reduction. Though not hard, the only way to become proficient with these tools is to use them, so let's practice.

In particular, the idea of using free variables to write the solution to a system of equations can be confusing, so we need extra practice with this.

Hidden objectives

Suggestions

Wrapup

Choose a question that most of the class has started but not yet finished, or a question that people particularly struggled with.

Solutions

1.