Stony Brook University
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Spring 2018

Problem Set 1

MAT 211: Linear Algebra

Homework Problems

1.1. *Elimination Method.* (10 points)

Solve the following system of linear equations using the method of elimination:

$$x + 2y + 3z = 1,$$
$$2x + 4y + 7z = 2,$$
$$3x + 7y + 11z = 8.$$

1.2. *Dependence on a Parameter.* (20 points)

Consider the linear system

$$x + y - z = -2,$$
$$3x - 5y + 13z = 18,$$
$$x - 2y + 5z = k,$$

where k is an arbitrary real number.

(a) For which value(s) of k does this system have one or infinitely many solutions?

(b) For each value of k you found in the previous part, how many solutions does the system have?

(c) Find all solutions for each value of k obtained in the first part.

1.3. *Application to Geometry.* (15 points)

Find a, b, and c such that the ellipse $ax^2 + bxy + cy^2 = 1$ passes through the points $(1, 2)$, $(2, 2)$, and $(3, 1)$.

1.4. *Gauss-Jordan.* (10+10 points)

Solve the following systems of linear equations using Gauss-Jordan elimination (i.e. write down the augmented matrix, and put it in RREF):

(a) $3x + 11y + 19z = -2,$
$7x + 23y + 39z = 10,$
$-4x - 3y - 2z = 6.$

(b) $x_1 + 2x_3 + 4x_4 = -8,$
$x_2 - 3x_3 - x_4 = 6,$
$3x_1 + 4x_2 - 6x_3 + 8x_4 = 0,$
$-x_2 + 3x_3 + 4x_4 = -12.$

1.5. *(Bonus problem) Integral Solutions.* (10 points)

Consider the system

$2x + y = C,$

$3y + z = C,$

$x + 4z = C,$

where C is a constant. Find the smallest positive integer C such that x, y, and z are all integers.

Due Date: Wednesday, February 7.