**In-Lab Group Activity for Week 2**

**Spring 2022**

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**Problem 1.** Given the following system of equations:

**a.** Write the system as a **matrix equation**  **.**

-1

1

2

-1 2 3

1 -2 -3

2 -4 -1

The desired coefficient matrix is: while the vector is:

**b.** Write as a **vector equation**:

That is, write as linear combination of columns of *A*.

The vectors are just the columns of the coefficient matrix *A*, so:

3

-3

-1

2

-2

-4

-1

1

2

x1 \* + x2 \*+ x3 \*=

The equivalent vector equation is:

-1 2 3 -1

1 -2 -3 1

2 -4 -1 2

**c.** Write the system as an **augmented matrix**

**d.** Row-reduce by hand. Notice the first two rows are dependent, so one can be cancelled and written as a row of zeros, move that to the bottom and move the other rows up. Finish row-reducing.

A piece of paper with writing on it

Description automatically generated

1 -2 0 1

0 0 1 0

0 0 0 0

**e.** Write the solution in parametric form. The fully reduced augmented matrix is:

**We see the system is consistent, but is a free variable. There are an infinite number of solutions.**

So:

(free)

**In parametric form the solution is:**

+

**f.** Use MATLAB to solve the system. Show all the code to enter *A* and , than use **matrix concatenation** to form the augmented matrix *AM*. Finally use **rref** to complete the row reduction. Show all your code in the box below.

% Problem 1 - MATLAB Solution

% Enter the system

A = [-1, 2, 3; 1, -2, -3; 2, -4, -1];

b = [-1; 1; 2];

% Combine to form the augmented matrix.

AM = [A, b];

% Row reduce

RAM = rref(AM);

Record MATLAB's answer for the RAM here. Use a monospaced font such as Courier.

**RAM =**

**1 -2 0 1**

**0 0 1 0**

**0 0 0 0**

**Problem 2: Parabola Through Three Points**

![Chart, line chart

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Each point where determines

one linear equation for the unknowns:

Given a parabola passes through the three points:

, and , find the equation for the parabola. That is find *a*, *b* and *c*.

**a.** First write out the three linear equations for the parabola's

coefficients. As an example, here is the equation determined by the first point.

🡪

Write the equation for the second point here:

**y(0) = 1 = a + 0\*b + 0\*0\*c -> a = 1**

Write the equation for the third point here:

**y(1) = 2 = a + 1\*b + 1\*1\*c -> a + b + c = 2**

**b.** Now you have three equations for your three unknowns *a*, *b* and *c*. Collect them into a linear system.

1 -2 4

1 0 0

1 1 1

Give the coefficient matrix

The vector on the right is and the unknown is .

**c.** Write the linear system as an augmented matrix and completely row reduce.

1 0 0 1

0 1 0 0

0 0 1 1

Text, letter

Description automatically generated

**d.** The unique solution for the coefficients of the parabola is

The equation of the parabola is therefore:

**i.**  **ii.** **iii.** **iv.**

Be sure to study the graph at the start of this problem and see that the parabola is indeed a perfect fit.