MA103: Mathematical Modeling

Matrices III - Matrix Inverse Method **30 October 2025**

1. Find the determinant of a matrix
2. Find the inverse of a matrix
3. Understand when matrix operations are possible based on dimensions
4. Represent a 2-by-2 system of linear equations as a matrix
5. Solve a system of linear equations using the inverse of a matrix
6. Explain the relationship between the number of solutions of a system of equations and the determinant of matrix

---

Complete the following for each system:

a) Graph the system. What does the graph tell you about the solution to the system?

b) Put the system into matrix-vector form.

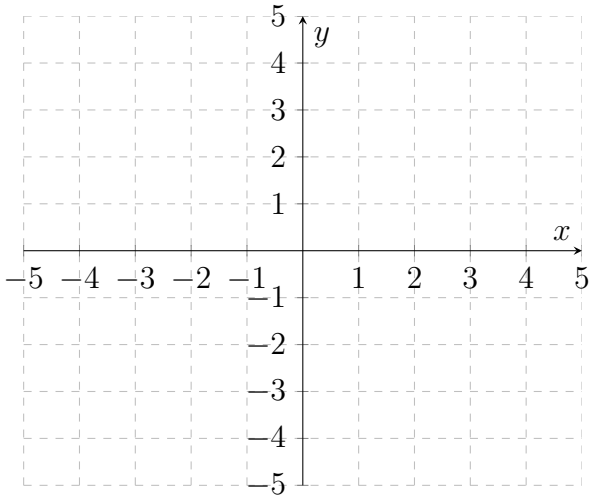
c) Find the determinant of the coefficient matrix. What does this tell you?

d) Find the inverse of the coefficient matrix.

e) Solve the system using matrix-inverse method, if possible.

1.

$$x - y = -1$$
$$3x + y = 9$$



Develop a system of equations and then solve it using Matrix-Inverse Method for the following problems.

2. Joe and Peter are excellent athletes. Joe runs at a speed of 10m/s and Peter runs at a speed of 8m/s. DPE wants to do an experiment. If the DPE instructor places Joe 10m behind the starting point of a 100m dash, and Peter 6m ahead of the starting point, will Joe beat Peter across the finish line?

3. Shortly after securing a small outpost near the Afghanistan/Pakistan border, your platoon sustains heavy enemy contact and is running low on 81mm ammunition. You are promised two bundles delivered via a low-cost low-altitude (LCLA) aerial delivering method "maxed out" with up to 300 lbs each of 81mm HE ammo in the morning, but an exact round count is unavailable. You pull the records from your last receipt:

Previously your mortar tubes were delivered in two separate bundles. The bundle tags read:

- Bundle 1: Two mortar tubes, 20 rounds of 81mm HE (242 lbs) total.
- Bundle 2: One mortar tube, 30 rounds of 81mm HE (281 lbs) total.

Assuming bundle weights "max out" at 300 lbs, how much 81mm HE ammo can you expect to receive?