Norwegian University of Science
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Department of Mathematical
Sciences

MA0002 Mathematical Methods B Spring 2024

Exercise set 5

1 a) Solve the linear system, then graph it to verify your solution.

$$\begin{aligned} 4x - y &= 8 \\ 3x + 2y &= -2 \end{aligned}$$

b) Now consider the linear system

$$\begin{aligned} x - 2y &= 3 \\ ax - 4y &= 1 \end{aligned}$$

Solve the system to get an expression with a. For which values of a does the system have: only one solution, infinitely many solutions, no solutions?

c) Given the functions

$$f_1(x, y) = 2x - y \text{ and } f_2(x, y) = -x + y,$$

we define the vectors

$$\mathbf{f} = \begin{bmatrix} f_1(x, y) \\ f_2(x, y) \end{bmatrix} \text{ and } \mathbf{u} = \begin{bmatrix} x \\ y \end{bmatrix}.$$

Find a matrix A, such that

$$\mathbf{f} = A \cdot \mathbf{u}.$$

2 Find all solutions (if there are any) to the linear systems

a)

$$\begin{aligned} 2x + 5y &= 1 \\ x + 2y &= -1 \end{aligned}$$

b)

$$\begin{aligned} 3x - y &= 2 \\ -9x + 3y &= 1 \end{aligned}$$

c)

$$\begin{aligned} x - 2y &= -2 \\ -2x + 4y &= 4 \end{aligned}$$

3 Find the augmented matrix and use it to solve the linear system.

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

4 Three different species of insects are reared together in a laboratory cage. They are supplied with two different types of food each day. Each day each individual of species 1 consumes 3 units of food A and 5 units of food B, each individual of species 2 consumes 2 units of food A and 3 units of food B and each individual of species 3 consumes 1 units of food A and 2 units of food B. Each day, 500 units of food A and 900 units of food B are supplied. How many individuals of each species can be reared together? Is there more than one solution?