Linear Algebra

Prof. Gerhard Jäger, summer term 2022

Assignment 03

1. (2 points) Compute the inverse of the matrix

$$\begin{bmatrix} a & b \\ c & d \end{bmatrix}$$

   Include all the intermediate steps in the solution!

2. (2 points) Consider the system of equations:

$$\begin{aligned} 3x + 4y &= 10 \\ 9x + 12y &= ? \end{aligned}$$

   Choose a right-hand side for the second equation such that the system has

   (a) no solution,

   (b) infinitely many solutions.

3. (3 points)
   (a) What 3×3 matrix $E_{1,3}$ will add row 3 to row 1?

   (b) What matrix adds row 1 to row 3 and *at the same time* row 3 to row 1?

   (c) What matrix adds row 1 to row 3 and *then* adds row 3 to row 1?

4. (2 points) Multiply these matrices:
   (a)

$$\begin{bmatrix} 0 & 0 & 1 \\ 0 & 1 & 0 \\ 1 & 0 & 0 \end{bmatrix} \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix} \begin{bmatrix} 0 & 0 & 1 \\ 0 & 1 & 0 \\ 1 & 0 & 0 \end{bmatrix}$$

   (b)

$$\begin{bmatrix} 1 & 0 & 0 \\ -1 & 1 & 0 \\ -1 & 0 & 1 \end{bmatrix} \begin{bmatrix} 1 & 2 & 3 \\ 1 & 3 & 1 \\ 1 & 4 & 0 \end{bmatrix}$$

5. Find the inverse of the permutation matrix

   (1 point)

$$\begin{bmatrix} 0 & 1 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$