

# Linear Algebra

Prof. Gerhard Jäger, winter term 2023/2024

## Assignment 01

1. (3 points) Describe geometrically (line, plane, or all of  $\mathbb{R}^3$ ) all linear combinations of

(a)  $\begin{pmatrix} -1 \\ 4 \\ 3 \end{pmatrix}$  and  $\begin{pmatrix} -3 \\ 12 \\ 9 \end{pmatrix}$

(b)  $\begin{pmatrix} -1 \\ 0 \\ 0 \end{pmatrix}$  and  $\begin{pmatrix} 0 \\ 0 \\ 9 \end{pmatrix}$

(c)  $\begin{pmatrix} -1 \\ 0 \\ 1 \end{pmatrix}$  and  $\begin{pmatrix} 0 \\ 2 \\ 0 \end{pmatrix}$  and  $\begin{pmatrix} -1 \\ 2 \\ 1 \end{pmatrix}$

2. (4 points) Let

$$\mathbf{u} = \begin{pmatrix} 1 \\ 2 \end{pmatrix}$$

$$\mathbf{v} = \begin{pmatrix} -1 \\ 2 \end{pmatrix}$$

(a) What is  $\mathbf{u} + \mathbf{v}$  and  $\mathbf{u} - \mathbf{v}$ ?

(b) Draw  $\mathbf{u}, \mathbf{v}, \mathbf{u} + \mathbf{v}, \mathbf{u} - \mathbf{v}$  on a plane.

3. (2 points) How many solutions has the following system of equations?

$$\begin{aligned} 2x + 3y - z &= 1 \\ 4x + 6y - 2z &= 2 \\ x + y + z &= 0 \end{aligned}$$

4. (2 points) How many solutions has the following system of equations?

$$\begin{aligned} 2x + 3y - z &= 1 \\ 4x + 6y - 2z &= 1 \\ x + y + z &= 0 \end{aligned}$$