

Link zum GitHub:

https://github.com/vanderfriedrich/DataScience_SoSe2022

Einsendeaufgabe 2

2. Linear Algebra Exercise (9. Mai and 5 points)

Create the solutions for all exercises given in the LE. Attach exactly one PDF which includes the solution!

2.4.2

Draw and calculate a 2 or/and 3 dimensional example.

Calculate the norm of b from the equation below.

$$\vec{b} = \begin{pmatrix} x \\ y \\ \sqrt{2 - x^2 - y^2} \end{pmatrix}$$

Handwritten calculation on grid paper showing the norm of vector \vec{b} . The text "Betrag des Vektors" is written at the top. The calculation is as follows:

$$|\vec{b}| = \left| \begin{pmatrix} x \\ y \\ \sqrt{2 - x^2 - y^2} \end{pmatrix} \right| = \sqrt{x^2 + y^2 + \left(\sqrt{2 - x^2 - y^2} \right)^2} = \sqrt{x^2 + y^2 + 2 - x^2 - y^2}$$
$$= \underline{\underline{\sqrt{2}}}$$

What is the unit vector of the vector with the values 5,1,8?

Betrag des Vektors

$$\vec{a} = \begin{pmatrix} 5 \\ 1 \\ 8 \end{pmatrix} \quad |\vec{a}| = \sqrt{5^2 + 1^2 + 8^2} = \sqrt{25 + 1 + 64} = \underline{\underline{\sqrt{90}}}$$

Einheitsvektor

$$\vec{a}^0 = \frac{1}{\sqrt{90}} \cdot \begin{pmatrix} 5 \\ 1 \\ 8 \end{pmatrix} = \begin{pmatrix} \frac{5}{\sqrt{90}} \\ \frac{1}{\sqrt{90}} \\ \frac{8}{\sqrt{90}} \end{pmatrix}$$

2.4.3

Now play with the matrix part of ImmersiveMath

- Make up a specific matrix $C=(4 \times 2)$
- What is the format of a new matrix D that can be multiplied with C ? (one easy example)
- Multiply these two.
- What is the resulting format of any matrix multiplication?

1.

$$C = \begin{pmatrix} 1 & 2 & 3 & 4 \\ 5 & 6 & 7 & 8 \end{pmatrix}$$

2. Matrix D 4×2

$$D = \begin{pmatrix} 1 & 2 \\ 3 & 4 \\ 5 & 6 \\ 7 & 8 \end{pmatrix}$$

3.

$$\begin{pmatrix} 1 & 2 & 3 & 4 \\ 5 & 6 & 7 & 8 \end{pmatrix} \cdot \begin{pmatrix} 1 & 2 \\ 3 & 4 \\ 5 & 6 \\ 7 & 8 \end{pmatrix} = \begin{pmatrix} 49 & 52 \\ 114 & 140 \end{pmatrix}$$

4. Das Format ist 2×2

2.8 Exercises MAT

1. **Multiply** the following two matrices manually:

$$\begin{pmatrix} 4 & 2 & 3 \\ 5 & 1 & 6 \end{pmatrix} * \begin{pmatrix} 3 & 2 \\ -1 & -3 \\ 6 & 8 \end{pmatrix}$$

21	15
50	55

Ergebnis:

$$\begin{pmatrix} 21 & 15 \\ 50 & 55 \end{pmatrix}$$

2. Determinant Do a little research:

- What is a **determinant** of a matrix?
- What can it be used for?
- What is the resulting determinant of this matrix (manually):

Eine Determinate ist der Wert einer quadratischen Matrix. Also einer Matrix die gleich viele Zeilen und Spalten hat.

Sie kann zum Lösen von linearen Gleichungen eingesetzt werden, zum Invertieren einer Matrix aber auch zur Flächenberechnung.

Die Berechnung der Determinate einer 2*2 Matrix entspricht:

$$|A| = \det(A) = \begin{vmatrix} a & b \\ c & d \end{vmatrix} = a \cdot d - b \cdot c$$

$$\begin{pmatrix} 1 & 3 & 4 \\ -2 & 3 & 5 \\ 2 & -3 & -4 \end{pmatrix}$$

Determinate:

$$(1*3*-4) + (3*5*2) + (4*-2*-3) - (4*3*2) - (3*-2*-4) - (1*5*-3)$$

$$=-12+30+24-24-24-15= |-21| = 21$$