

Linear Algebra

Prof. Gerhard Jäger, winter term 2023/2024

Assignment 02

1. (3 points) Compute $\mathbf{u} \cdot \mathbf{v}$ for

(a)

$$\mathbf{u} = \begin{bmatrix} -2 \\ 3 \end{bmatrix}$$

$$\mathbf{v} = \begin{bmatrix} 1 \\ 0 \end{bmatrix}$$

(b)

$$\mathbf{u} = \begin{bmatrix} \frac{1}{10} \\ -1 \\ \frac{2}{3} \end{bmatrix}$$

$$\mathbf{v} = \begin{bmatrix} \frac{10}{3} \\ -\frac{1}{3} \\ \frac{1}{2} \end{bmatrix}$$

(c)

$$\mathbf{u} = \begin{bmatrix} 1 \\ 0 \\ 1 \\ 1 \\ 1 \end{bmatrix}$$

$$\mathbf{v} = \begin{bmatrix} 1 \\ 1 \\ 0 \\ 0 \\ 0 \end{bmatrix}$$

2. (3 points) Find a non-zero vector \mathbf{v} that is orthogonal to \mathbf{u} .

(a)

$$\mathbf{u} = \begin{bmatrix} 1 \\ 1 \end{bmatrix}$$

(b)

$$\mathbf{u} = \begin{bmatrix} 1 \\ 3 \\ 2 \end{bmatrix}$$

(c)

$$\mathbf{u} = \begin{bmatrix} 1 \\ -1 \\ -1 \\ 2 \end{bmatrix}$$

3. (2 points) Calculate $A^T \mathbf{v}$

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

$$\mathbf{v} = \begin{bmatrix} 1 \\ 1 \\ -1 \end{bmatrix}$$

4. (2 points) Calculate AB and BA . Does $AB = BA$ hold for the following matrices?

$$A = \begin{bmatrix} 1 & 2 & 0 \\ 2 & 1 & 2 \\ 0 & 1 & 2 \end{bmatrix}$$

$$B = \begin{bmatrix} 0 & 2 & 1 \\ 2 & 1 & 2 \\ 2 & 1 & 0 \end{bmatrix}$$