Linear Algebra

Introduction to Vectors

Linear Algebra

- Linear algebra is the study of lines and planes, vector spaces, and mappings, all of which are necessary for linear transformations.
- It is a branch of mathematics, but the truth of it is that linear algebra is the mathematics of data. Matrices and vectors are the language of data.

Linear Algebra For Machine Learning

- It is a key foundation to the field of machine learning, from notations used to describe the operation of algorithms to the implementation of algorithms in code.

https://machinelearningmastery.com/examples-of-linear-algebra-in-machine-learning/

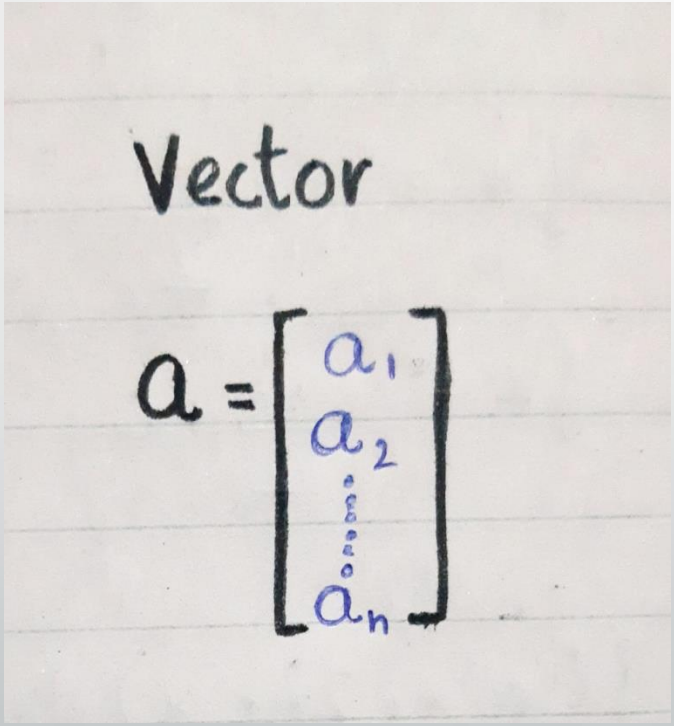
Applications of Linear Algebra

- As linear algebra is the mathematics of data, the tools of linear algebra are used in many domains.
- Matrices in Engineering, such as a line of springs.
- Graphs and Networks, such as analyzing networks.
- Markov Matrices, Population, and Economics, such as population growth.
- Linear Programming, the simplex optimization method.
- Fourier Series: Linear Algebra for Functions, used widely in signal processing.
- Linear Algebra for Statistics and Probability, such as least squares for regression.
- Computer Graphics, such as the various translation, scaling and rotation of images.

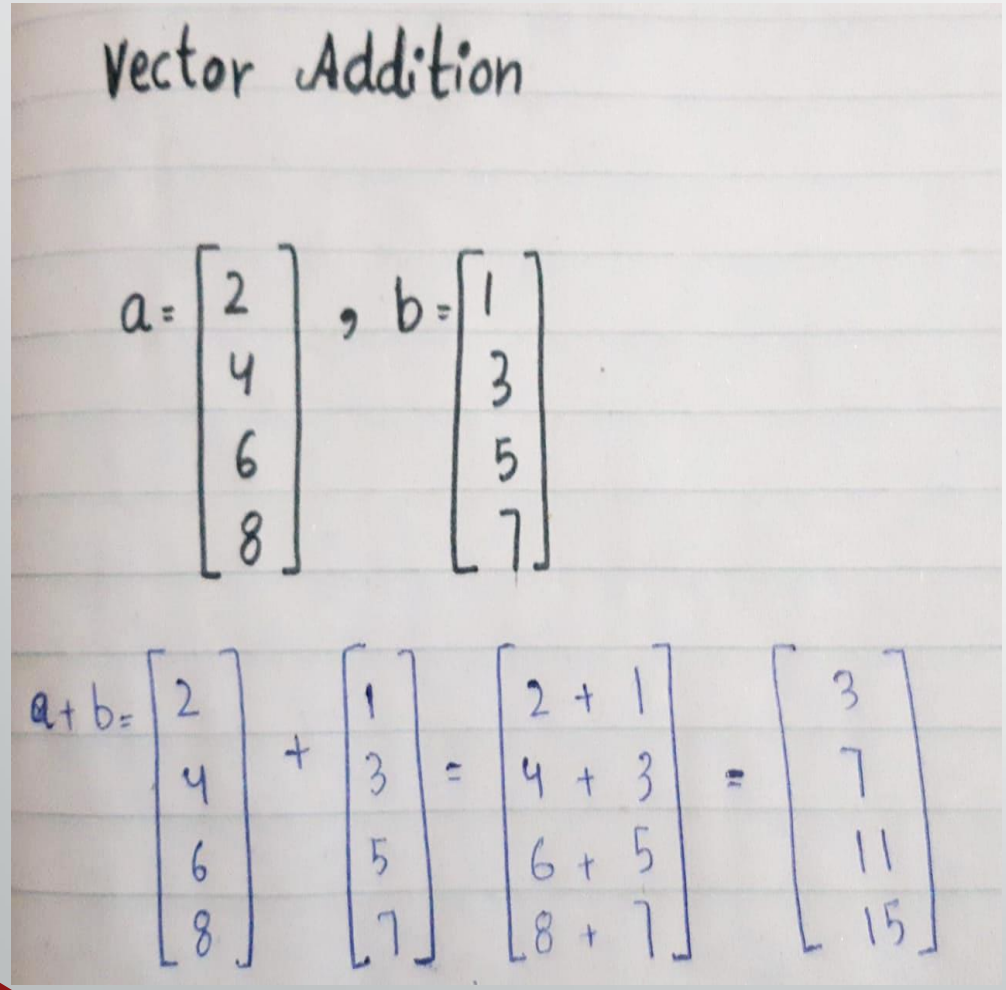
https://machinelearningmastery.com/linear-algebra-machine-learning-7-day-mini-course/

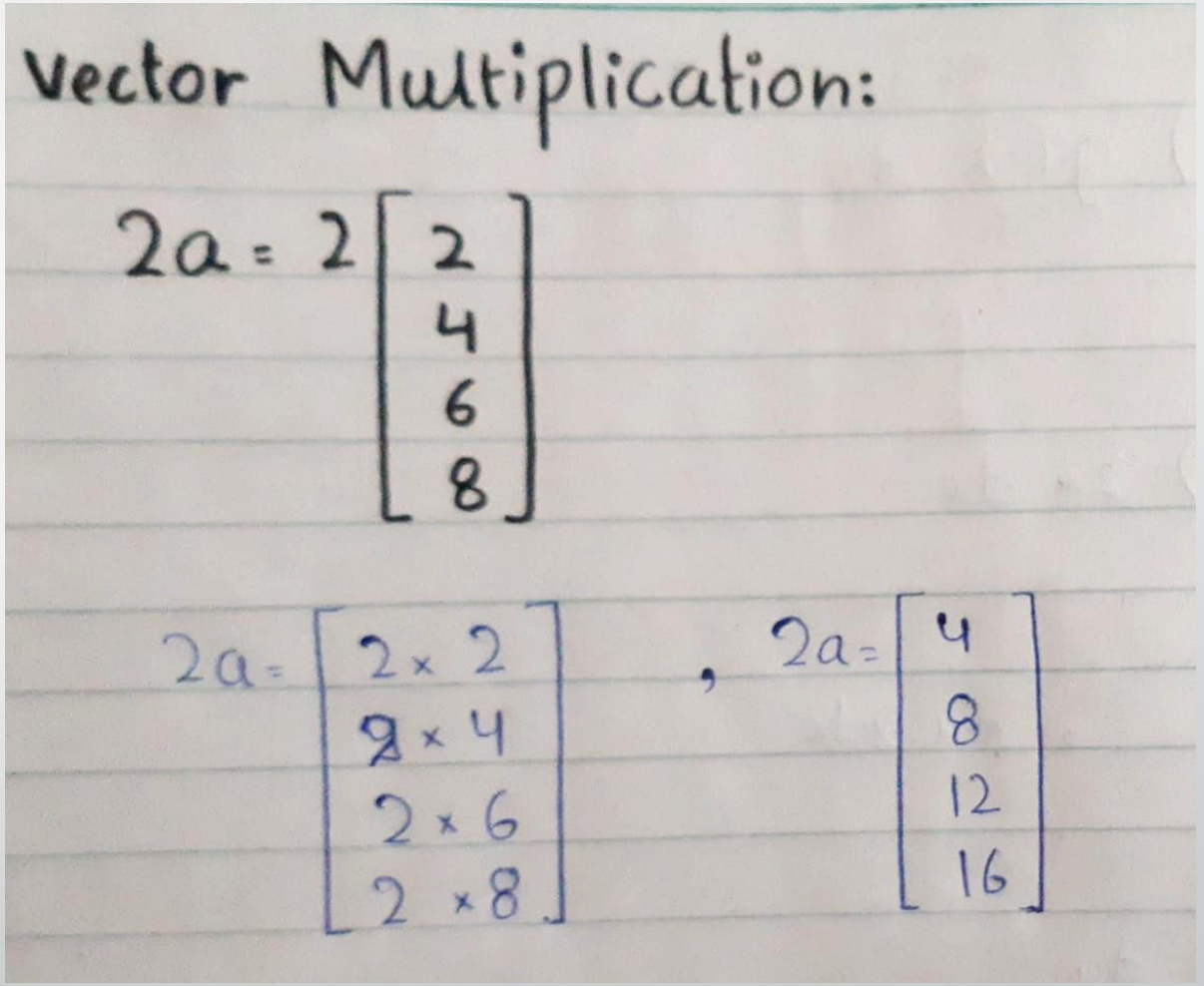
Defining a Vector

- Vectors are an array of numbers in which the order of the numbers is important.
- A lowercase bold letter, such as **a**, is commonly used to indicate Vectors.



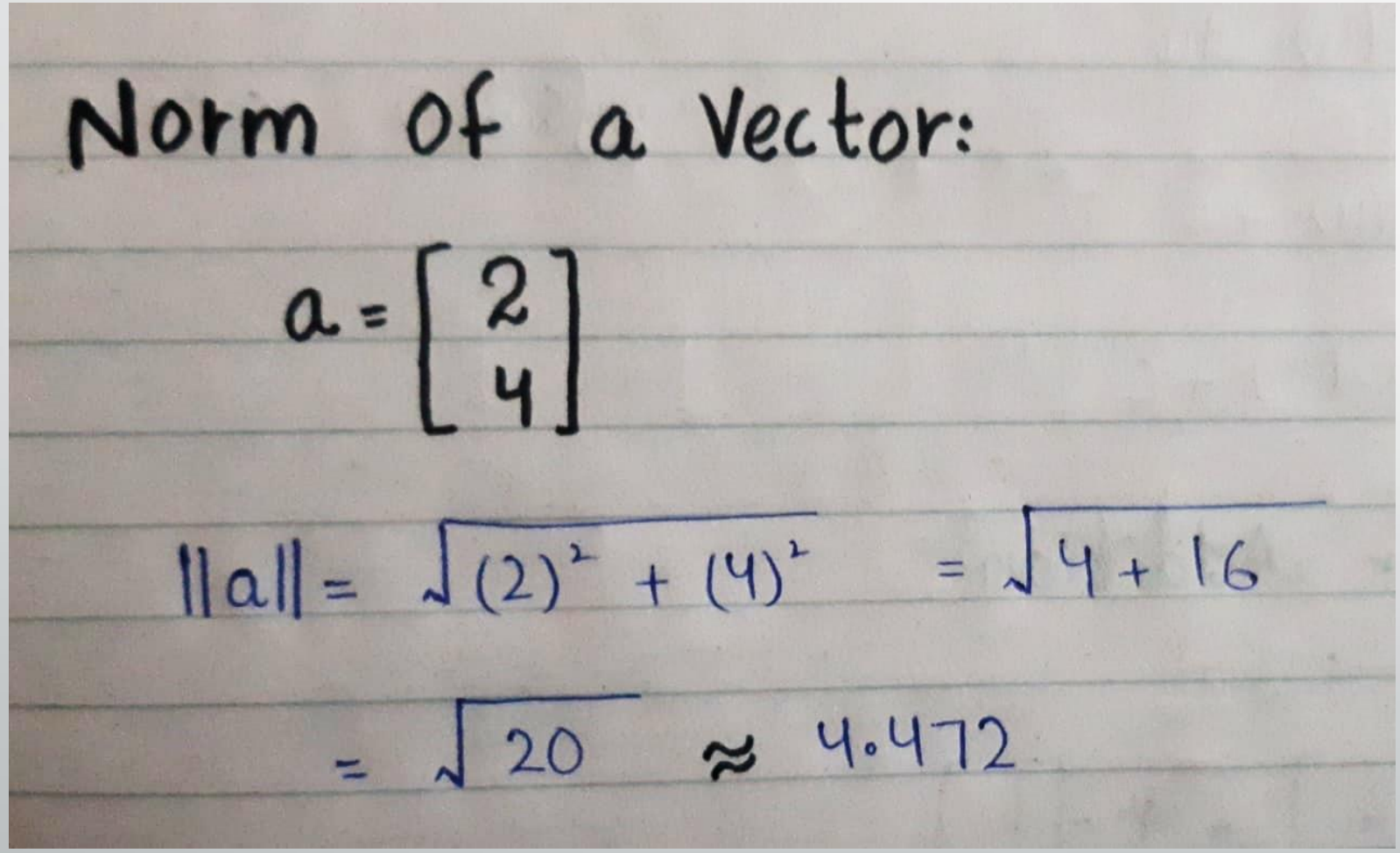
Vector Addition and Multiplication





Norm of a Vector

- The magnitude ||a|| of a vector is measured by its norm.



Dot product of two vectors

$$a \cdot b = a_1 b_1 + a_2 b_2 + a_3 b_3 + \cdots\cdots a_n b_n .$$

$$a = \begin{bmatrix} -2 \\ 4 \\ 8 \end{bmatrix}, \quad b = \begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix}$$

$$a \cdot b = a_1 b_1 + a_2 b_2 + a_3 b_3 .$$

$$a \cdot b = (-2 \times 1) + (4 \times 2) + (8 \times 3)$$

$$a \cdot b = (-2 + 8 + 24) .$$

$$a \cdot b = 30$$