Worksheet

Problem 1. Convex combinations I

What shapes can you obtain from convex combinations of four vectors in the plane?

(Write the singular form of one shape, without articles(the/a), as a single word.)

Problem 2. Convex combinations II

What shapes can you obtain from convex combinations of four vectors in the volume, assuming that the four vectors do not all fall into a single plane?

(Write the singular form of one shape, without articles (the/a), as a single word.)

Problem 3. Matrix muliplication using einsum

For two matrices A and B, the i, j-th component of the product AB is given by

$$(AB)_{ij} = \sum_k A_{ik} B_{kj}$$

Given two numpy arrays A and B, write an `einsum` expression that realizes matrix multiplication:

(Write the call as `einsum(...)`, ignoring the reference to the numpy module.)

Problem 4. Dot products in vector spaces

Does every vector space have a dot product?

(A) No.

(B) Yes.

Problem 5. Dot product using einsum

For two vectors consisting of numbers

$$x = \begin{bmatrix} x_1 \\ \vdots \\ x_n \end{bmatrix} \text{ and } y = \begin{bmatrix} y_1 \\ \vdots \\ y_n \end{bmatrix}$$

the dot product is given by

$$x \cdot y = \sum_{i=1}^{n} x_i y_i$$

Given two numpy arrays x and y, write an `einsum` expression that realizes matrix multiplication: (Write the call as `einsum(...)`, ignoring the reference to the numpy module.)