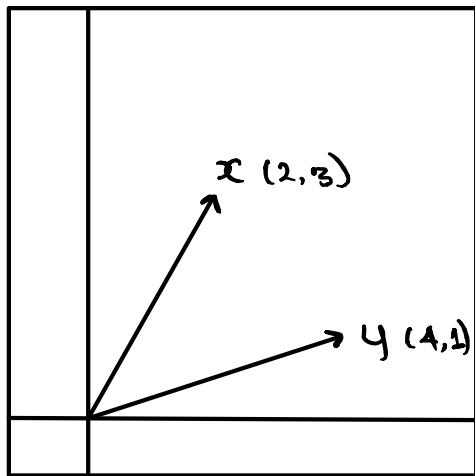


The difference in length between two vectors is the length of the difference vector.

$$d(x, y) = \|x - y\|$$
$$= \sqrt{\langle x - y, x - y \rangle} \quad \text{, where the distance is dependent on the definition of the inner product.}$$

(*) when the inner product is defined by the dot product, the distance is named the euclidean distance.

Example of Distance:



$$x - y = \begin{bmatrix} 2 - 4 \\ 3 - 1 \end{bmatrix}$$
$$= \begin{bmatrix} -2 \\ 2 \end{bmatrix}$$

When the inner product is the dot product:

$$\|x - y\| = \sqrt{4 + 4}$$
$$= \sqrt{8}$$

Let the Inner Product be defined:

$$\langle x, y \rangle = x^T \begin{bmatrix} 1 & -\frac{1}{2} \\ -\frac{1}{2} & 1 \end{bmatrix} y$$

$$= \sqrt{12}$$