LINEAR ALGEBRA AND ITS APPLICATIONS
UE19MA251

Orthogonal Vectors & Subspaces

Definition:

The ***norm or length*** of a n-dimensional vector $x = (x_1, x_2, \ldots, x_n)$ is written as $\| x \|$ and is defined as

$$\|x\| = \sqrt{x_1^2 + x_2^2 + \ldots + x_n^2}$$

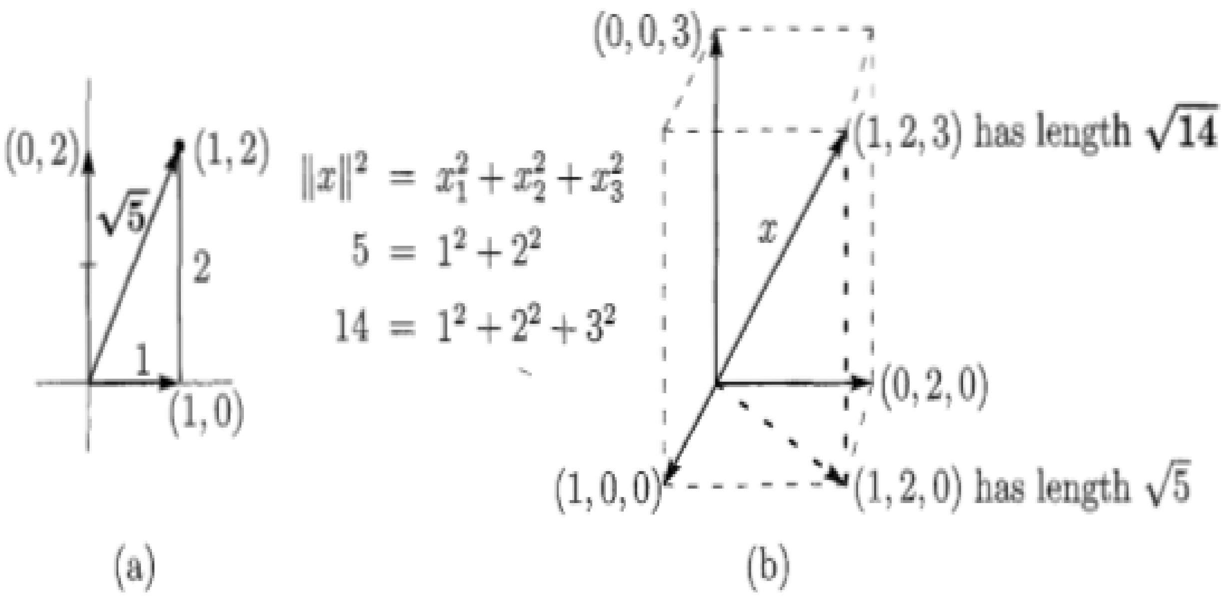
We can also write

$$\|x\|^2 = x^T x$$

Note : Zero is the only vector whose norm is 0.

Unit 3. Linear Transformations and Orthogonality

Orthogonal Vectors & Subspaces



Orthogonal Vectors & Subspaces

Definition:

The ***inner product*** or dot product or scalar product of two vectors x = ($x_1, x_2, \ldots., x_n$) and y = ($y_1, y_2, \ldots., y_n$) is denoted by

$$x^T y \ \ or \ \ x \circ y \ \ or \ \ \langle x , y \rangle$$

and is defined by

$$x^T y = x_1 y_1 + x_2 y_2 + \ldots.. + x_n y_n$$

Note that $$x^T y = y^T x$$

Orthogonal Vectors & Subspaces

Definition :

Two vectors $x = (x_1, x_2, ..., x_n)$ and $y = (y_1, y_2, ..., y_n)$ are said to be ***orthogonal*** if

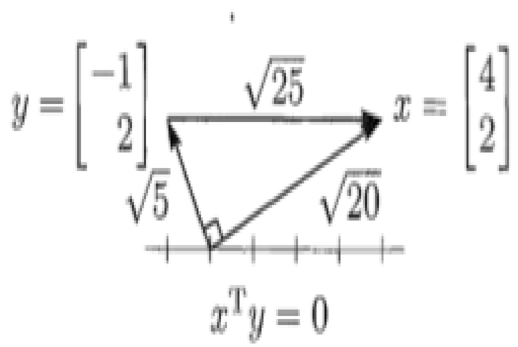
$$x^T y = y^T x = 0$$

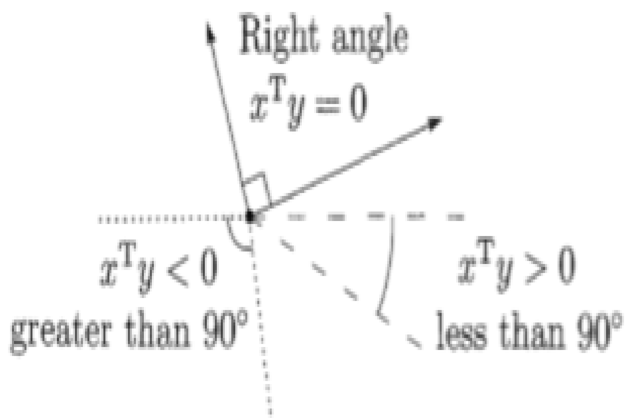
Note :

1. Zero is the only vector that is orthogonal to itself.
2. Zero is the only vector that is orthogonal to every other vector.

Unit 3. Linear Transformations and Orthogonality

Orthogonal Vectors & Subspaces





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Examples

1.The coordinate vectors (1, 0, …., 0) , (0, 1, 0,…, 0) , ….., (0, 0, …., 0, 1) are mutually orthogonal in R^n.

2. The vectors (c, s) , (-s, c) are orthogonal in R^2.
3. The vectors (2, 1, 0) , (-1, 2, 0) are orthogonal in R^3.

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THANK YOU