Points, Vectors, and Coordinate Systems

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Coordinate System

In computer graphics a coordinate system is a system which uses one or more numbers, or coordinates, to uniquely determine the position of a point in 2 or 3-dimensional Euclidean space.
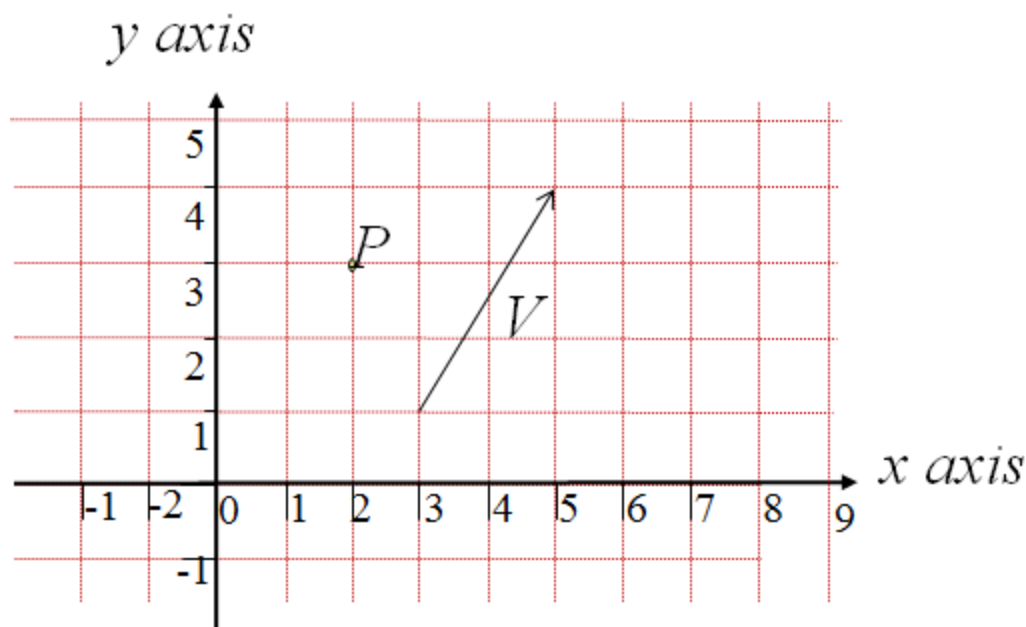
2-dimensional space:

Points:

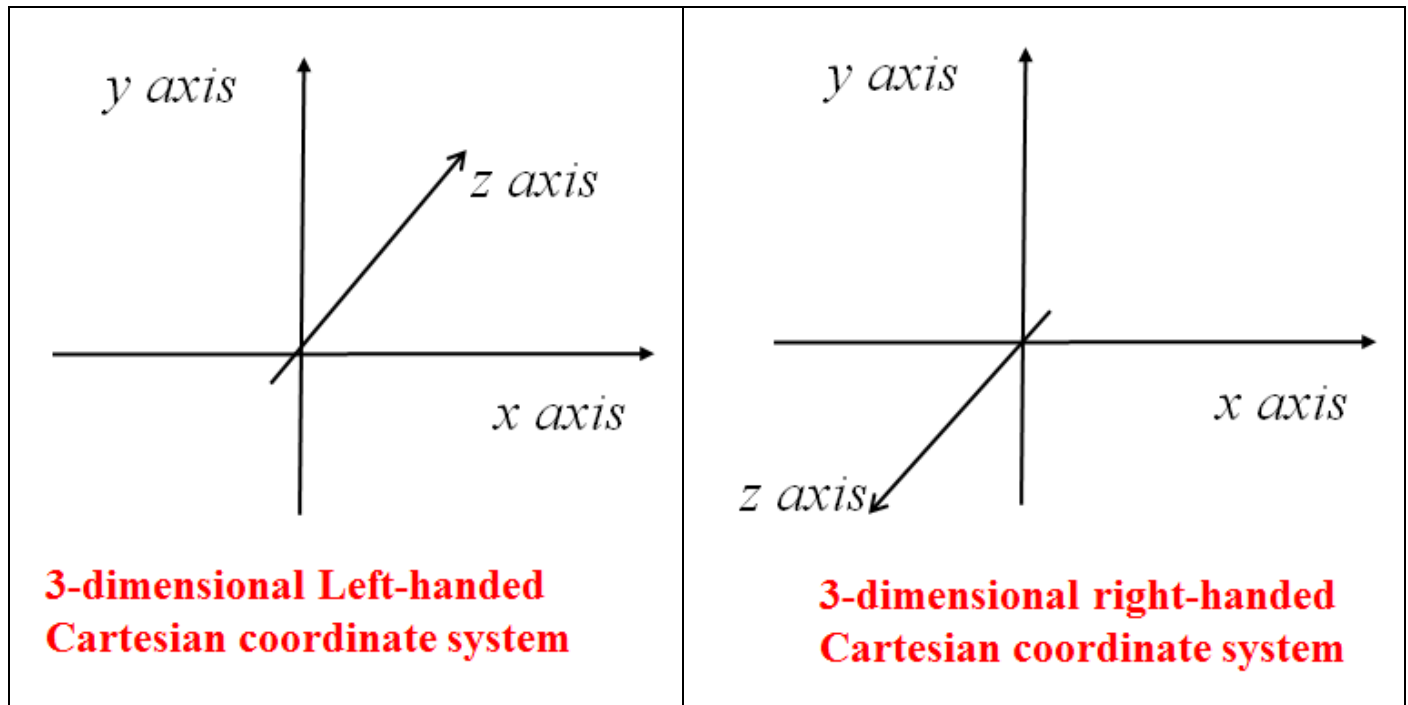a point, p, in 2-dimensional space is represented tuples of numbers: $P = \begin{bmatrix} x \\ y \end{bmatrix}$

Vectors:

a vector, v, in 2-dimensional space may represent direction, normal to a surface, force, etc, and is also represented by tuples of numbers: $\overrightarrow{V} = \begin{bmatrix} x \\ y \end{bmatrix}$

3-dimensional space:

The Cartesian coordinate systems in 3-dimensional space are either right-handed or left-handed

3-dimensional Left-handed Cartesian coordinate system

3-dimensional right-handed Cartesian coordinate system

Points:

a point, p, in 3-dimensional space represents a location and is presented by tuples of numbers such as:

$$p = \begin{bmatrix} x \\ y \\ z \end{bmatrix}$$

Vectors:

a vector, v, in 3-dimensional space may represent direction, normal to a surface, force, etc, and is also

represented by tuples of numbers such as: $\vec{v} = \begin{bmatrix} x \\ y \\ z \end{bmatrix}$

Notes:

- Since the vectors and points have the same representation, it is important to make a distinction between the concept of vector and point.
- Adding a vector to another vector creates a new vector.
- It is meaningless to add two points.
- Adding a vector to a point creates another point.
- Subtracting a point from another point creates a vector.