EPGL - Linear Function

By Mr. Cheng Wing Cheong Tommy

EPGL – Linear Function

Objectives:

- To understand the basic theory of linear function and its application.
- To understand the vector and the coordinate system R2 and R3 and its application.
- To learn how to solve simultaneous equation, matrix operation and the relation between linear functions from R2 to R2 and from R3 to R3.
- To learn determinant calculation.

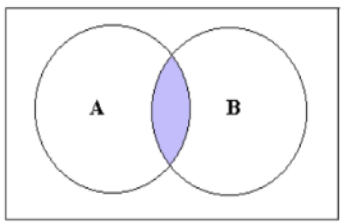
Common Lecture Notes (in English) will be used.

Brief Descriptions of Topics

Topics Covered:

- Set Theory and Cartesian Coordinate system
- Vectors in $\mathbb{R}^1$, $\mathbb{R}^2$ and $\mathbb{R}^3$ and its application
- Functions and Linear Functions in $\mathbb{R}^1$, $\mathbb{R}^2$ and $\mathbb{R}^3$
- Matrix and Linear Functon
- Simultaneous equation
- Determinant

About Set Theory



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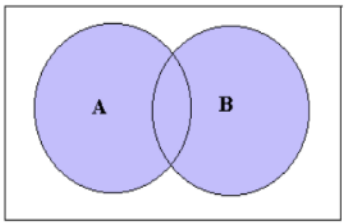

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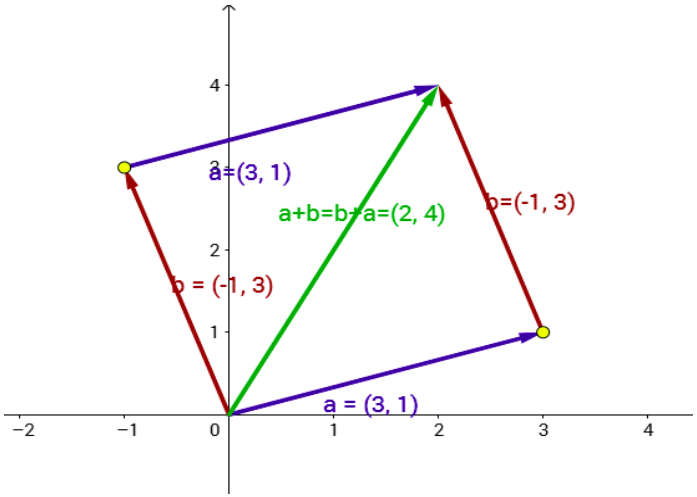
Brief Descriptions of Topics

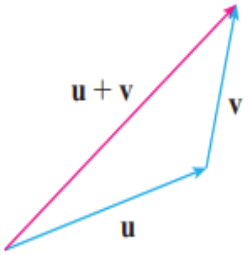
Product set and Vectors in $\mathbb{R}^1$, $\mathbb{R}^2$ and $\mathbb{R}^3$ and its application.

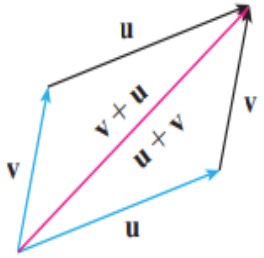
$\mathbb{R} \times \mathbb{R} = \{(x, y): x \in \mathbb{R} \text{ and } y \in \mathbb{R}\}$

Vectors and Coordinate System



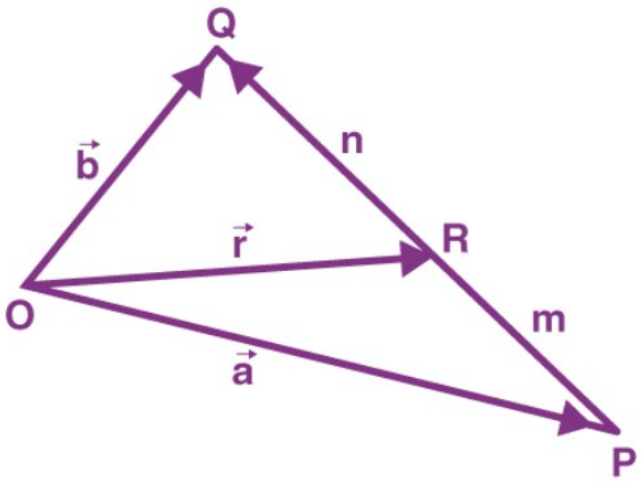
Triangle Law and Parallelgram Law





Brief Descriptions of Topics

Section Formula of vectors:



$$\overrightarrow{OR}=\frac{n}{m+n}\overrightarrow{OA}+\frac{m}{m+n}\overrightarrow{OB}$$

How to find the center of gravity of a triangle?

Brief Descriptions of Topics

Matrix Multiplication (Row by Column)

$$\begin{pmatrix} 1 & 2 & 3 \\ 5 & 0 & 4 \\ 0 & 1 & 0 \end{pmatrix} \begin{pmatrix} a \\ b \\ c \end{pmatrix} = \begin{pmatrix} 1a + 2b + 3c \\ 5a + 0b + 4c \\ 0a + 1b + 0c \end{pmatrix} = \begin{pmatrix} 1a + 2b + 3c \\ 5a + 4c \\ b \end{pmatrix}$$

Brief Descriptions of Topics

Simultaneous equation

$$1a + 2b + 3c = 2$$
$$5a + 0b + 4c = 4$$
$$0a + 1b + 0c = 6$$

Find the solution set of the above simultaneous equation.

Brief Descriptions of Topics

Determinant

$$\begin{vmatrix} a & b \\ c & d \end{vmatrix} = ad - bc$$

$$\begin{vmatrix} 1 & 2 & 3 \\ 5 & 0 & 4 \\ 0 & 1 & 6 \end{vmatrix} = ?$$

Linear Function

Although we will have a lot of **computations** during this course, we also emphasize on the followings:

1. **The Linear function concept in high level Mathematical Analysis.**
   The local behaviour of a function is linear.
   Kyrie Irving (NBA Star) Doesn't Know if the Earth Is Round or Flat.

2. Given ***F is a linear function.***
   F: $\mathbb{R}^3 \to \mathbb{R}^3$
   We know that a 3x3 matrix M is also a linear function from
   M: $\mathbb{R}^3 \to \mathbb{R}^3$
   What is the relation between F and a 3x3 matrix M?