

# Conceptual Mathematics Note

Session 1 Multiplications of Objects

PART 1 The Category of Sets

Article 1 Sets, maps, composition

An example of category

Composition of Maps

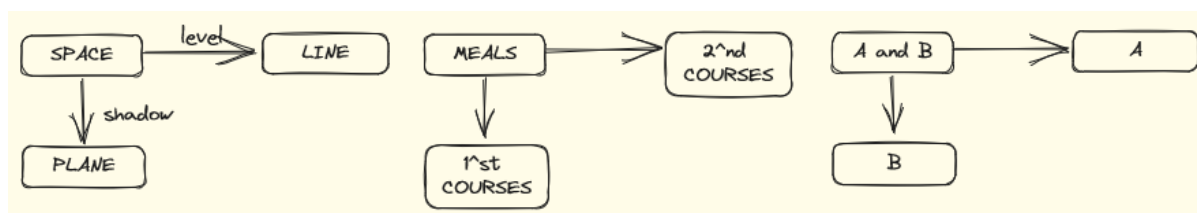
Rules

Point

Session 2 Review

PART 2 The algebra of composition

## Session 1 Multiplications of Objects



## PART 1 The Category of Sets

### Article 1 Sets, maps, composition

#### An example of category

Category of finite sets and maps:

- Object: one finite set or collection
- Map: consists of a set A, a set B and a rule  $b = f(a)$ 
  - dot in domain has one out, dot in codomain(target) has any number of in.
  - If  $A = B$ , called **endomap**

Notion:

| internal diagram: draw arrow from each dot to each target dot

| external diagram: draw one arrow from set A to B

## Composition of Maps

$$A \rightarrow B \rightarrow C$$

### Rules

| identity laws: composition of f and I equals to f

| associative law:  $h(gf) = (hg)f$

### Point

singleton set: a set with only 1 element, called as '1'

| Definition: A point of a set X is a map  $1 \rightarrow X$



Point is a map and it picks out one element in X  
Composing it with another map also gets a point

## Session 2 Review

$(x + 1)^2 = x^2 + 2x + 1$  are different rules, on natural numbers they always provide the same result for the same input, so the maps of the two rules f, g are the same map.

in a category, maps are same if:

| f, g have the same domain and codomain

| each point  $1 \rightarrow A$ ,  $f a = g a$

## **PART 2 The algebra of composition**