Week 1

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I started reading the book "**Conceptual Mathematics**". I have read the first two sections today. Key points for each session are listed below:

Section 1:

- Firstly, we see examples for Categories:
  1. Galileo's bird's flight puzzle which talks about a relationship between the objects 'time' and 'space' where the bird travels.
  2. The 'space' talked above can again be split into two objects: the 'plane' where the shadow of the bird lie, and the level of flight of bird which is a 'line'.
  3. Other examples like the a category of two dishes (a relation with 1st and 2nd course dishes).
- In the next part, we relate many topics in set theory with category theory like functions as morphisms etc. A **category of finite sets** contains:
  1. Data for the Category:
     (1) Objects: the sets $\mathbf{A}, \mathbf{B}, \mathbf{C}, ...$
     (2) Maps: functions like $f, g, ...$
  2. Rules:
     (1) Identity law: if $\mathbf{A} \xrightarrow{f} \mathbf{B}$, then, $I_B \circ f = f \;\; \& \;\; f \circ I_A = f$.
     (2) Associative law: $h \circ (g \circ f) = (h \circ g) \circ f$.

Section 2:

- Some definitions: Consider the category $\mathbf{A} \xrightarrow{f} \mathbf{B}$,
  1. The set **A** is called the Domain of map 'f'.
  2. The set **B** is called the Co-Domain of map 'f'.
  3. A **rule** for map 'f', is that each element in **A** must be mapped to only one element in **B**.
- **Test for equality** of two maps:
  A **point** of a set **A** is a map from a **singleton set 1** to **A**. Using this, we can say that " two maps f and g with domain **A** and co-domain **B** are said to be equal iff for all points $\mathbf{1} \xrightarrow{a} A$, $f \circ a = g \circ a$, then $f = g$. "
- Internal and External Diagrams:
  - Internal: uses the arrow diagrams where the elements of the set are shown.
  - External: shows mapping with arrows between sets as a whole without explicitly showing the elements in them.