Note: Problem Set 0 Available

1 Functions:

$\boxed{f : A \to B \text{ means } f \text{ is a function from set } A \text{ to set } B}$

This means for each element of a ($a \in A$) there's a corresponding $f(a) \in B$
In the above definition, A is the **domain** where B is the **codomain** so we **MAP** elements from the domain to the codomain
Example:
Take the sets:

$$A = \{0, 2, 4\}$$
$$B = \{1, 2, 3\}$$

Define $f : A \to B$ by $f(x) = \frac{x}{2} + 1$

Some notes about Functions:

- You cannot have one value in A corresponding to multiple values of B
- You CAN have multiple values in A corresponding to a single value of B
- We also say that $f(x)$ is called the image of x
  - $f(x) \in B$. It is **NOT** the function since we do not know what x is.
  - We must distinguish between the function f and the element of B, $f(x)$
- Say we define f by $f(x) = \frac{x^2-3x}{x-3}$ ...well for what f
  - We must define a domain
  - Possible example could be $f : \mathbb{R} - 3 \to \mathbb{R}$
  - Another option is "Define $f : \mathbb{R} \to \mathbb{R}$ by $g(x)$" which means "for each $x \in \mathbb{R}$, let $g(x) = x$"
  - We must be clear about "what x" when we define functions

2 Predicates:

Given: $P : A \to \{\text{True, False}\}$ so P maps to the set of boolean values
Example:
Define: $P : \mathbb{R} \to \{\text{T, F}\}$ by $P(x) : x > 165$ With this we can say the set of values in the domain where $P(x) = T$ which is:

$$\{x \in \mathbb{R} : P(x) = T\}$$

So we're interested in the "Set in the predicate where the given condition is true"

3 Notation:

$\sum$ is for adding up numbers where there is a sequential pattern.
Take:

$$4 + \frac{9}{2} + \frac{16}{3} + \cdots + \frac{164^2}{164}$$

which can be notated as

$$\sum_{i=1}^{164} \frac{(n+1)^2}{n}$$

or

$$\sum_{i=2}^{165} \frac{n^2}{n-1}$$

Note: A method for breaking down the above summation is puting it in a uniform form so rewrite it as:

$$\frac{2^2}{1} + \frac{3^2}{2} + \frac{4^2}{3} + \cdots + \frac{165^2}{164}$$

There is a convention that if we take a sum from on value to a value that is one fewer than the originating value, the sum is 0.
Example:

$$\sum_{i=165}^{164} \frac{i}{i-1} = 0$$

Similarily, Π is $f(a) * f(a+1) * \cdots * f(b)$ so:

4 Propositional Logic

$\boxed{\text{A proposition is a statement that is true ... or it's false}}$

$x < 165$ is **not** a proposition since it is dependent on x
Some Propositional statements could be:

- (valid) It's sunny in Los Angeles right now
- (valid) There is life on Europa
- (invalid) She likes cauliflower - well who is "she"?