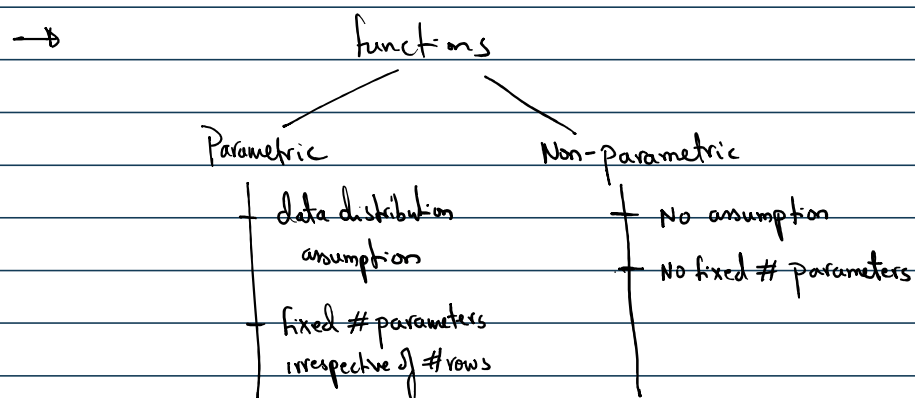


→ **Functions:** A function is a mathematical rule that takes an input value, processes it according to a specific formula or set of instructions, and produces a unique output value. A function is a relationship b/w input and output values where each input is connected to exactly one output.

→ **Multi-variable functions** :-  $f(x_1, x_2, x_3, \dots, x_n) \rightarrow n+1 \text{ dim}$

→ **Parameters in a function**:- Parameters of a function are the variables that are used to define the behaviour of the function. The parameters influence the function's output by determining how the input values are processed. The parameters are the constants or coefficients that appear in the function's formula.

→ **Machine Learning Models as Mathematical Functions**



→ A **loss function**, is a mathematical function that measures the difference b/w the predicted output and the actual target values in a ML model. The primary goal of training a ML model is to minimize the value of the loss function, which corresponds to improving the model's performance on the given task. Loss functions play a crucial role in the optimization process, guiding the learning algorithm to adjust the model's parameters to achieve better predictions.

→ **How to select a good loss function**

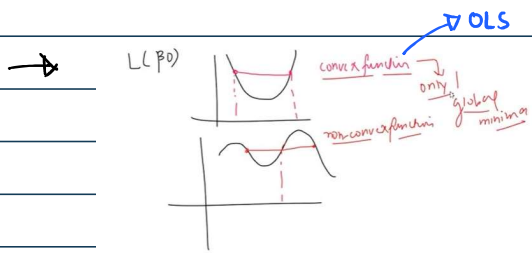
- Problem type
- Robustness to outliers
- Interpretability & ease of use
- Differentiability
- Compatibility with the model

\* given a scenario a single loss function cannot satisfy all these condition hence we have different loss functions. But they all serve the same purpose

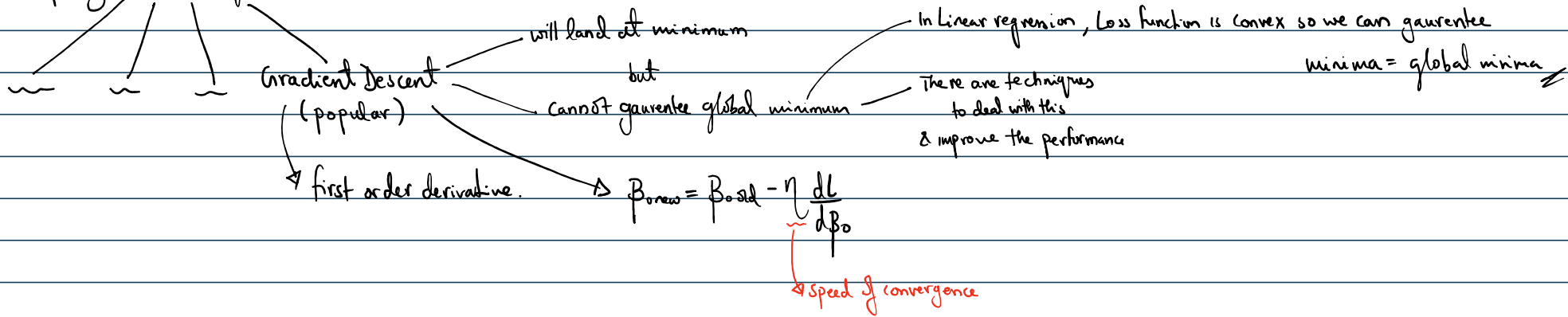
→  $\frac{dy}{dx} = 0$  → Limited scenarios

→ **Problems:**

- Non-convexity
- Complexity
- Scalability
- Online learning and streaming data



## → Optimization techniques



## → Problems faced with GD

- Non-convexity
- ill-conditioning
- Vanishing & exploding gradients
- overfitting
- scalability