

⑧ Define graph and epigraph of a function, convex function.

Graph of a function:

The graph of a function is a visual representation of the relationship between the output input and <sup>the</sup> output of that function.

The graph of  $f: \Omega \rightarrow \mathbb{R}, \Omega \subset \mathbb{R}^n$  is the set of points in  $\Omega \times \mathbb{R} \subset \mathbb{R}^{n+1}$  given by  $\{[x, f(x)]^T : x \in \Omega\}$

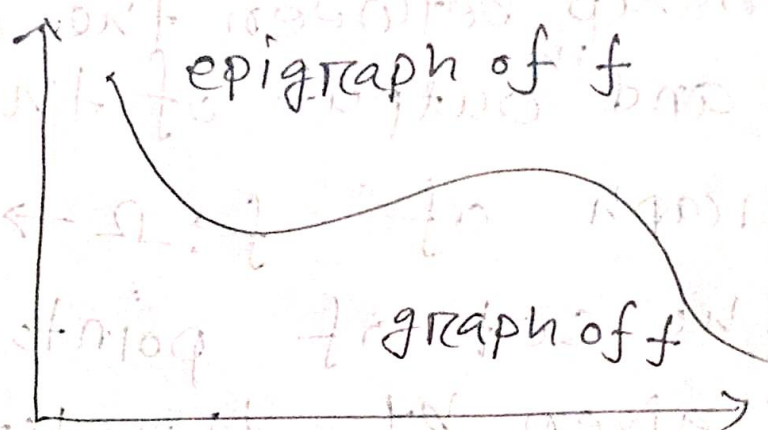
We can visualize the graph of  $f$  as simply the set of points on a "plot" of  $f(x)$  verses  $x$ .

Epigraph of a function: The

epigraph of a function is a set of points in a higher dimensional space, typically defined for real valued function, where the function values are greater than or equal to a certain constant.



The epigraph of a function  $f: \Omega \rightarrow \mathbb{R}$ ,  $\Omega \subset \mathbb{R}^n$ , denoted by  $\text{epi}(f)$ , is the set of points in  $\Omega \times \mathbb{R}$  given by

$$\text{epi}(f) = \{ [x, \beta]^T : x \in \Omega, \beta \in \mathbb{R}, \beta \geq f(x) \}$$


The graph and epigraph of a function  $f: \mathbb{R} \rightarrow \mathbb{R}$

The epigraph  $\text{epi}(f)$  of a function  $f$  is simply <sup>the</sup> set of point in  $\Omega \times \mathbb{R}$  on or above the graph of  $f$ .

⑧ Define Lagrangian function. What are the Lagrange conditions. Write down the Karush-Kuhn-Tucker conditions.