



### Definition

Let  $f : D \rightarrow \mathbf{R}$  be a multivariate real-valued function where  $D \subset \mathbf{R}^d$ . The *graph* of  $f$  is the set in  $\mathbf{R}^{d+1}$  defined by

$$\{(x, f(x)) \in \mathbf{R}^d \times \mathbf{R} \mid x \in D\}.$$

The *epigraph* of  $f$  is the set in  $\mathbf{R}^{d+1}$  defined by

$$\{(x, t) \in \mathbf{R}^d \mid x \in D \text{ and } f(x) \leq t\}.$$

### Notation

We denote the epigraph of a function  $f$  by  $\text{epi } f$ .

### Connecting convex sets and convex functions

A function  $f : \mathbf{R}^d \rightarrow \mathbf{R}$  is convex if and only if  $\text{epi } f$  is a convex set.

### Note on terminology

The prefix “epi” is Greek, meaning “above”.



