
3. CONVEX FUNCTIONS

CONVEX FUNCTIONS

Definition of convex function

First-order conditions

Second-order conditions

CONVEX FUNCTIONS

Sublevel sets

Epigraph

Jensen's inequality

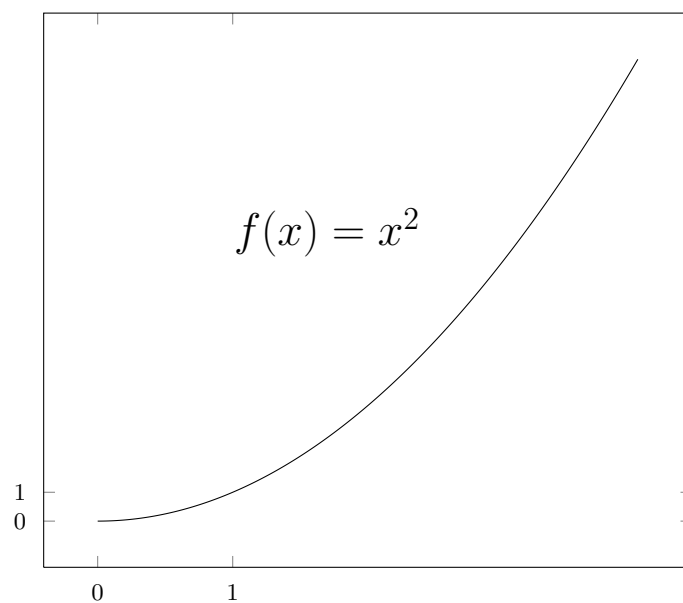
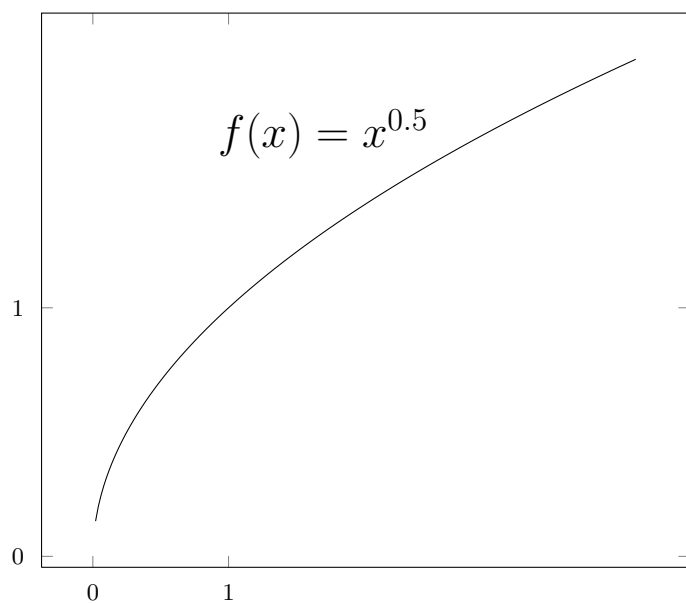
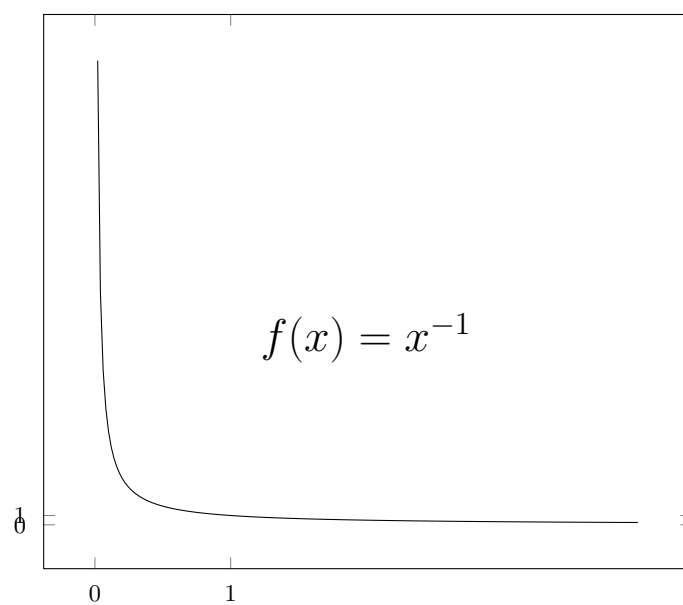
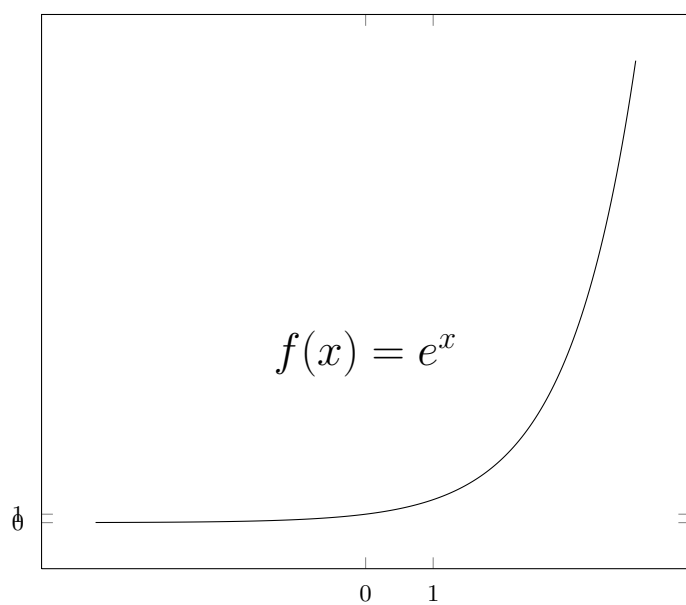
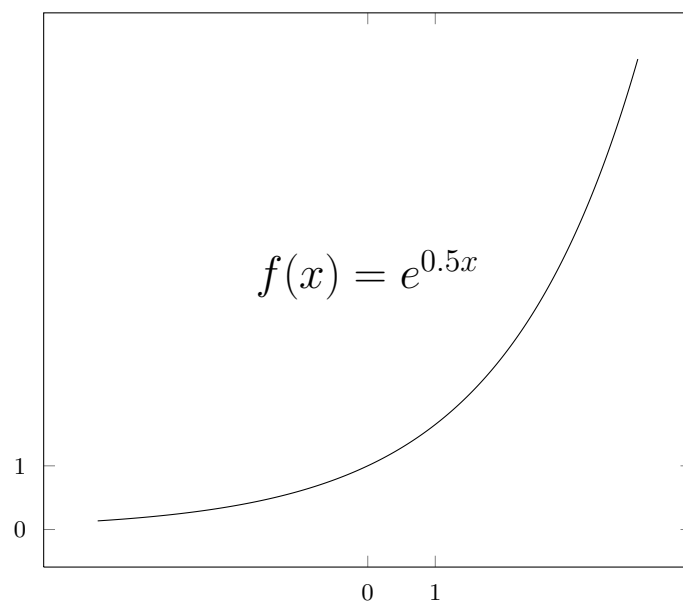
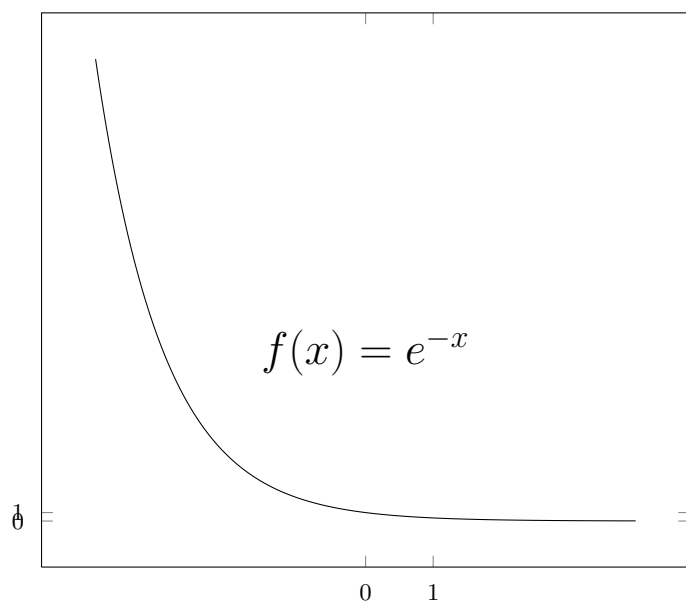
CONVEX FUNCTIONS

How to determine that a function is convex?

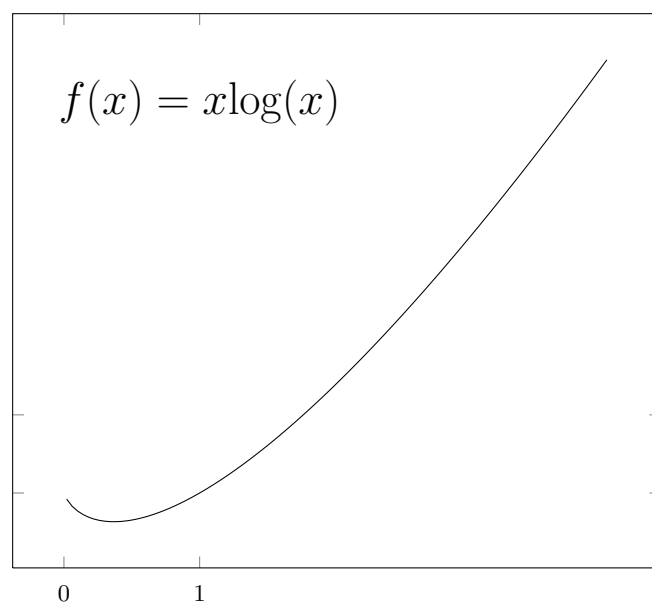
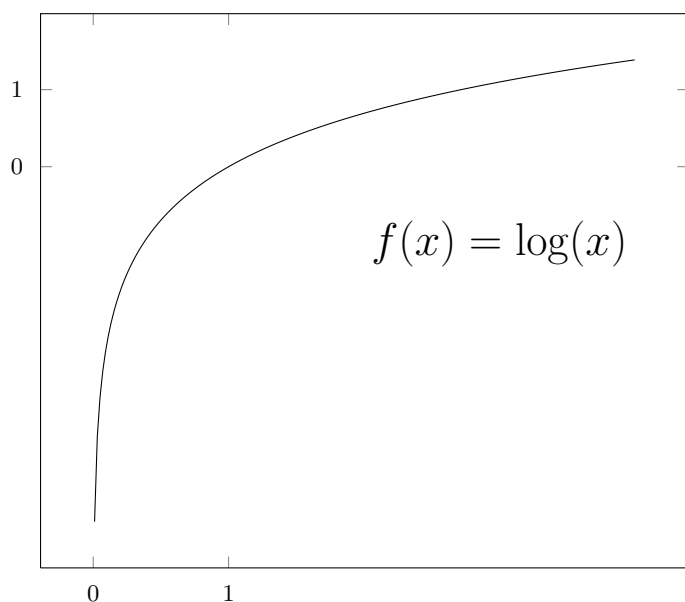
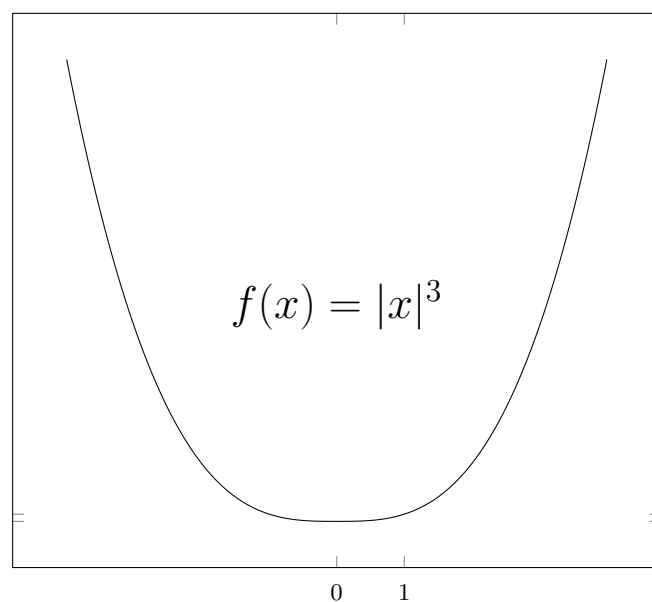
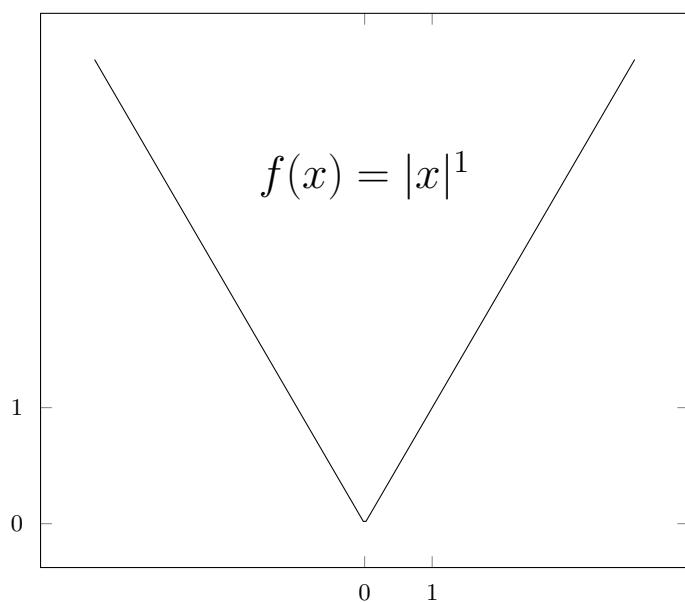
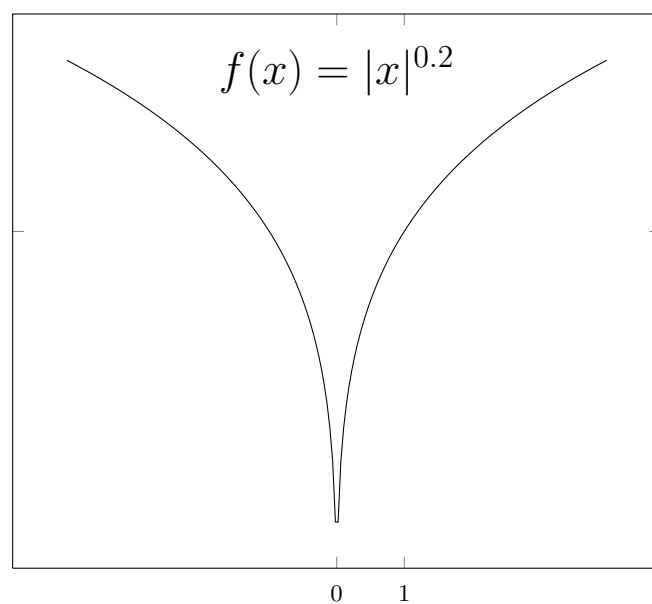
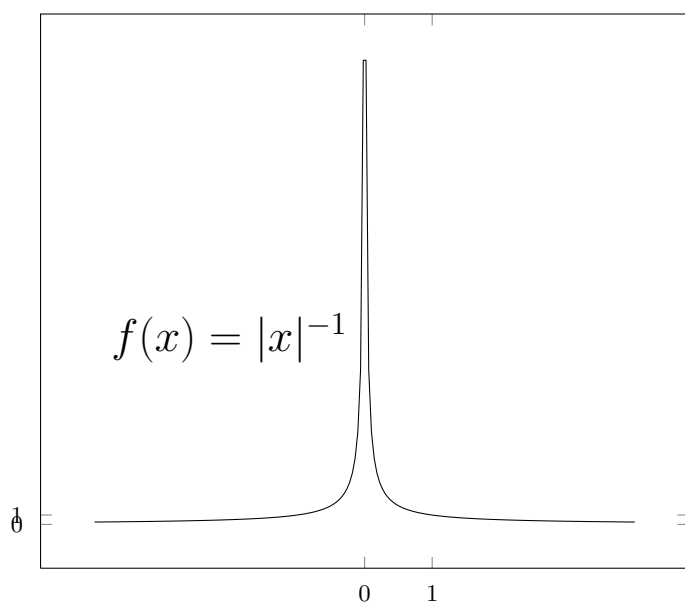
BASIC CONVEX FUNCTIONS

Function	Convex	Concave	
e^{ax} on $\mathbb{R}$	☐	☐	_____
x^a on $\mathbb{R}_{++}$	☐	☐	_____
x^a on $\mathbb{R}_{++}$	☐	☐	_____
$ x ^p$ on $\mathbb{R}$	☐	☐	_____
$\log(x)$ on $\mathbb{R}_{++}$	☐	☐	_____
$x \cdot \log(x)$ on $\mathbb{R}_{++}$	☐	☐	_____
$\ x\ $ on $\mathbb{R}^n$	☐	☐	_____
$\max\{x_1, \dots, x_n\}$ on $\mathbb{R}^n$	☐	☐	_____
x^2/y on $\mathbb{R} \times \mathbb{R}_{++}$	☐	☐	_____
$\log(e^{x_1} + \dots + e^{x_n})$ on $\mathbb{R}^n$	☐	☐	_____
$(\prod_{i=1}^n x_i)^{1/n}$ on $\mathbb{R}_{++}^n$	☐	☐	_____
$\log \det X$ on $\mathbb{S}_{++}^n$	☐	☐	_____

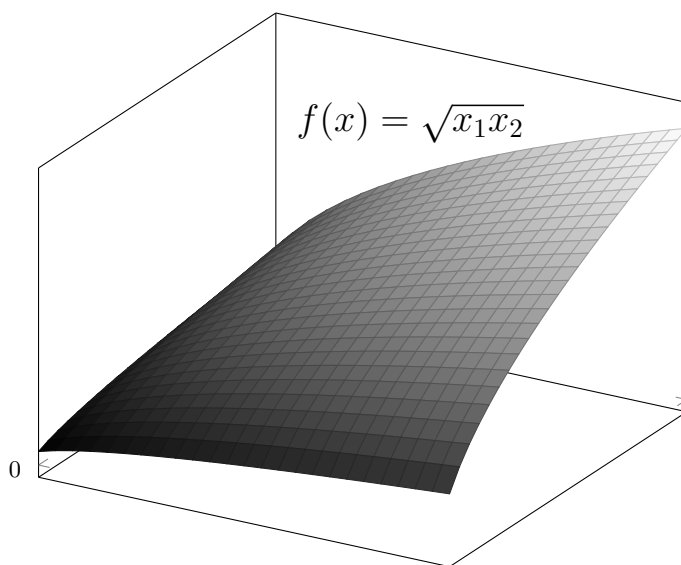
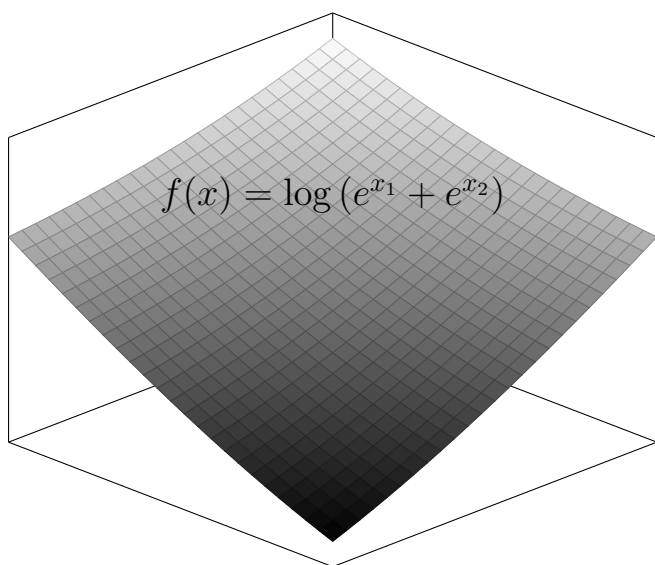
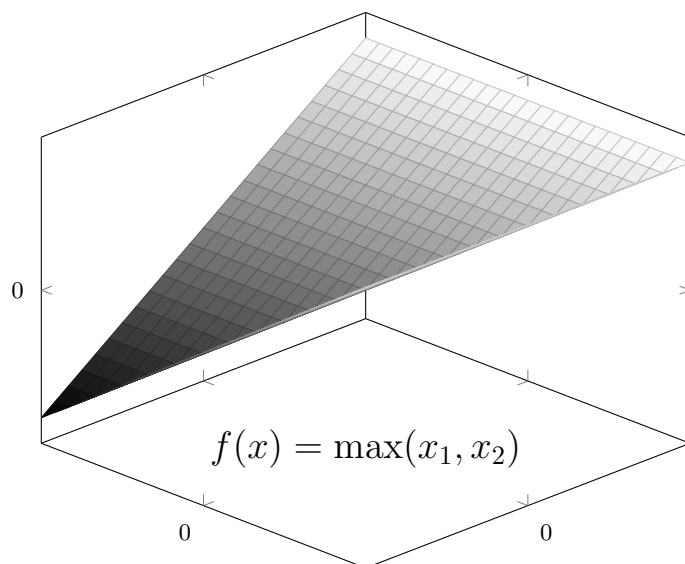
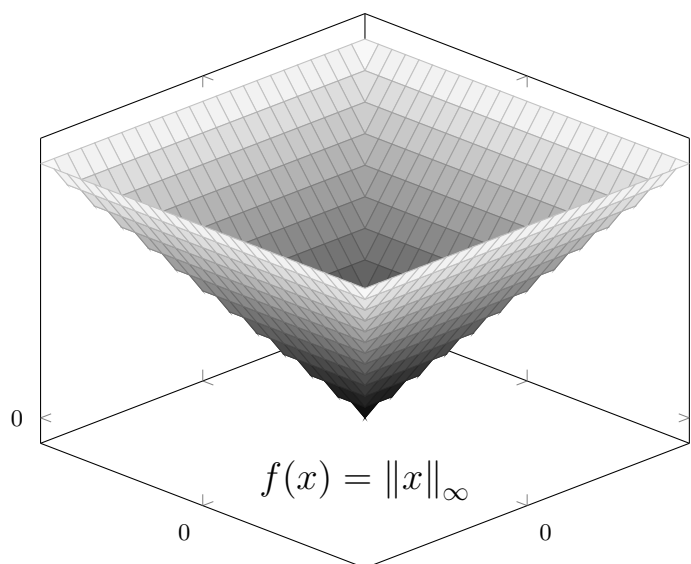
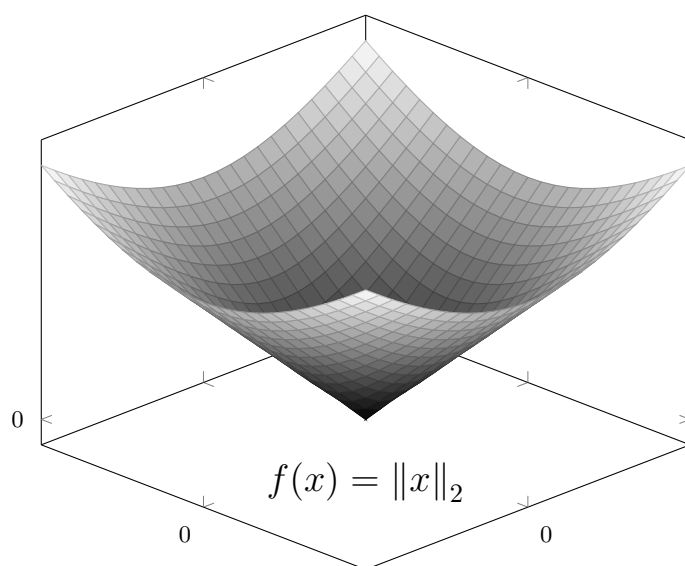
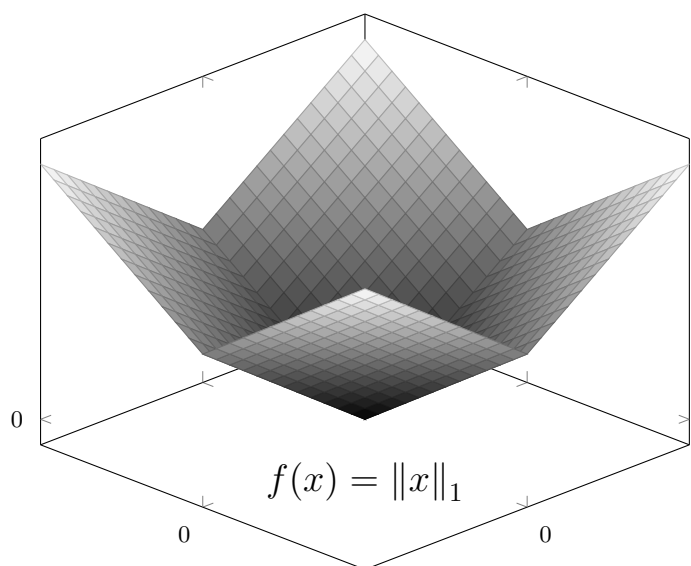
BASIC CONVEX FUNCTIONS



BASIC CONVEX FUNCTIONS



BASIC CONVEX FUNCTIONS



OPERATIONS THAT PRESERVE CONVEXITY

QUASICONVEX FUNCTIONS

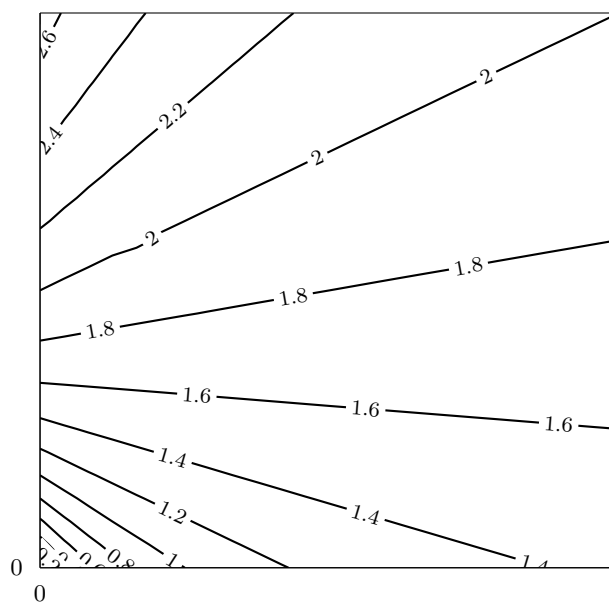
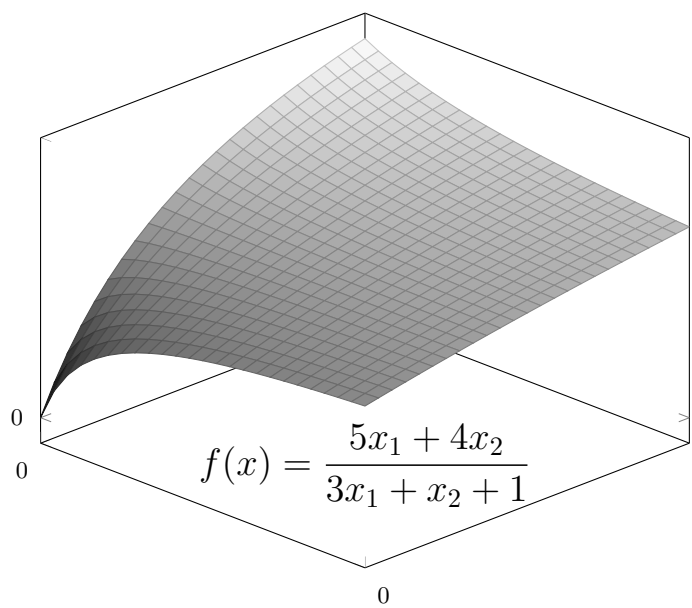
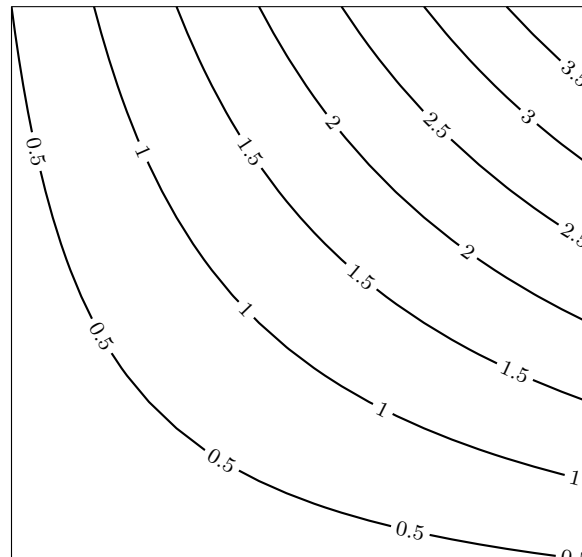
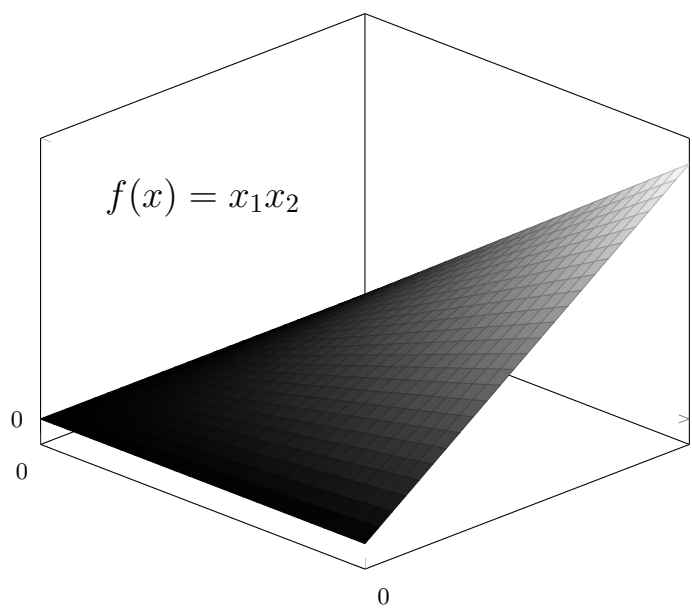
Definition of quasiconvex function

Properties of quasiconvex function

Quasiconvex function

Non-quasiconvex function

QUASICONVEX FUNCTIONS



LOG-CONVEX FUNCTIONS

Definition of log-convex function

Properties of log-convex function

Example of log-convex function

CONVEXITY W.R.T. GENER. INEQUALITIES

Monotonicity wrt GI

Convexity wrt GI