

Sets			
Set	Convex?	Proof	
$C = A \cup B$	Not always		
$C = A \cap B$	Yes, if $A$ and $B$ are convex sets.		
Functions			
Function	Convex?	Proof	
$\mathbf{y} = \max(f_1, f_2)$	Yes, if $f_1$ and $f_2$ are convex functions		
$\mathbf{y} = \min(f_1, f_2)$	Not always		
$C = \{\mathbf{x} \in \mathbb{R}^n \mid \mathbf{A}\mathbf{x} = \mathbf{b}, \mathbf{A} \in \mathbb{R}^{m \times n}, \mathbf{b} \in \mathbb{R}^m\}$	It is an affine set (all affine set is a convex set)		
$y = \mathbf{c}^\top \mathbf{x}$ (linear function)	Yes (but not strictly convex)		
$y = \ \mathbf{x}\ _p$ (p-norm)	Yes (for any $p \in \mathbb{N}_+$ )	$\ \theta \mathbf{x} + (1 - \theta)\mathbf{y}\  \leq \theta \ \mathbf{x}\  + (1 - \theta) \ \mathbf{y}\ $ (triangular inequality)	
$f(g(\mathbf{x}))$	Yes, if $f, g$ are convex		
Function	Domain	Codomain	Comments
System of linear equation: $\mathbf{b} = f(\mathbf{x}) = \mathbf{A}\mathbf{x}$	$D = \{\mathbf{x} \in \mathbb{R}^n \mid \mathbf{A}\mathbf{x} = \mathbf{b} \in C, \mathbf{A} \in \mathbb{R}^{m \times n}\}$	$C = \{\mathbf{b} \in \mathbb{R}^m \mid \mathbf{b} = \mathbf{A}\mathbf{x}, \forall \mathbf{x} \in D\}$	If $D$ is an affine set, so $C$ is also affine set which, in turn, is a convex set.