

# Notes for Mathematical Analysis

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# *Contents*

1.1	Metric Spaces	2
1.2	Open Sets	3

# *Metric Spaces and Normed Linear Spaces*

## §1.1 Metric Spaces

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Let  $X$  be any non-empty set. A *distance function* on  $X$  is a mapping  $d: X \times X \rightarrow [0, \infty)$  which satisfies the *distance axioms*. That is, for any  $x, y, z \in X$ ,

M1.  $d(x, y) \geq 0$  ;

M2.  $d(x, y) = d(y, x)$  ;

M3.  $d(x, z) \leq d(x, y) + d(y, z)$  .

The ordered pair  $(X, d)$  is called a *metric space*.

## §1.2 Open Sets

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Let  $(X, d)$  be a metric space. A set  $A \subset X$  is said to be *open* iff

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