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and Geometric  
Methods of Analysis**

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## LIST OF TOPICS

- Topological methods in analysis
- Geometric problems of complex and mathematical analysis
- Algebraic methods in geometry
- Differential geometry in the whole
- Geometry and topology of differentiable manifolds
- General and algebraic topology
- Geometric and topological methods in natural sciences

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# The local $\tau$ -density of a linearly ordered spaces

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A set  $A \subset X$  is said to be dense (in  $X$ ), if  $[A] = X$ . The density of the space  $X$  is defined as the smallest cardinal  $|A|$ , where  $A$  is a dense subset of  $X$  [1]. This cardinal is denoted by  $d(X)$ . If  $d(X) = \tau$ ,  $\tau \geq \aleph_0$ , the space  $X$  is said to be  $\tau$ -dense. If  $d(X) \leq \aleph_0$ , then  $X$  is said to be separable.

A topological space  $X$  is called locally  $\tau$ -dense at the point  $x \in X$ , if  $\tau$  is the smallest cardinal number, such that  $x$  has a neighbourhood of density  $\tau$  in  $X$  [2]. Local density at  $x$  is denoted by  $ld(x)$ . Local density of the space  $X$  is defined as follows:

$$ld(X) = \sup \{ld(x) : x \in X\}.$$

It is clear that local density of a topological space cannot exceed the density of said space, i.e.  $ld(X) \leq d(X)$ .

We say that the weak density of the topological space is  $\tau \geq \aleph_0$ , if  $\tau$  is the smallest cardinal number such that there exists a  $\pi$ -base coinciding with  $\tau$  of centered systems of open sets, i.e. there is a  $\pi$ -base  $B = \cup \{B_\alpha : \alpha \in A\}$  where  $B_\alpha$  is a centered system of open sets for each  $\alpha \in A$ ,  $|A| = \tau$  [3]. Weak density of topological space  $X$  is denoted by  $wd(X)$ .

Topological space  $X$  is said local weak  $\tau$ -dense at a point  $x$ , if  $\tau$  is the smallest cardinal number such that  $x$  has a neighborhood of weak density  $\tau$  in  $X$  [4]. Local weak density at a point  $x$  is denoted by  $lwd(x)$ . The local weak density of a topological space  $X$  is defined as the supremum of all numbers  $lwd(x)$  for  $x \in X$  :

$$lwd(X) = \sup \{lwd(x) : x \in X\}.$$

It is clear that local weak density of a topological space cannot exceed the weak density of said space, i.e.  $lwd(X) \leq wd(X)$ .

Let  $X$  be a set, and  $<$  be some relation on  $X$ . We say that  $<$  is a linear order on  $X$  if the relation  $<$  satisfies the following properties:

- 1) If  $x < y$  and  $y < z$ , then  $x < z$ ;
- 2) If  $x < y$  then the relation  $y < x$  does not hold;
- 3) If  $x \neq y$  then either  $x < y$  or  $y < x$  holds.

A set  $X$  together with some linear order defined on it is called a linearly ordered set [1].

**Theorem 1.** *Suppose that a space  $X$  satisfies at least one of the following conditions:*

- 1)  $X$  is a linearly ordered topological space with the interval topology,
- 2)  $X$  is pseudometric space.

*Then  $X$  is locally  $\tau$ -dense if and only if it is locally weak  $\tau$ -dense.*

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