Épreuve de section européenne

1 General Knowledge

What is the definition of the derivative of a function at a point ? What is the relationship between this number and the tangent to a curve at a point ?

2 Document

The theory of sets, initiated by the German mathematician G. Cantor (1842-1918), constitutes the basis of almost all modern mathematics. The set concept itself cannot be defined in simpler terms. A set is often described as a collection ("aggregate", "class", "totality", "family") of objects of any specified kind. However, such descriptions are no definitions, as they merely replace the term "set" by other undefined terms. Thus the term "set" must be accepted as a primitive notion, without definition. Examples of sets are as follows : the set of all men ; the set of all letters appearing on this page ; the set of all straight lines in a given plane ; the set of all positive integers ; the set of all English songs ; the set of all books in a library ; the set consisting of the three numbers 1, 4, 17.

[...]

Definition 1

For any two sets A and B, we define as follows :

(a) The union, or join, of A and B, denoted by $A \cup B$, is the set of all elements x such that $x \in A$ or $x \in B$ (i.e., the set of all elements of A and B taken together).

(b) The intersection, or meet, of A and B, denoted by $A \cap B$, is the set of all elements x such that $x \in A$ and $x \in B$ simultaneously (it is the set of all common elements of A and B).

(c) The difference $A - B$ is the set of all elements that are in A but not in B (B may, but need not, be a subset of A).

From *Basic Concepts of Mathematics*, by Elias Zakon.

3 Questions

1. Is there a definition of the notion of "set" ? If so, give this definition. If not so, explain why.
2. What are the main sets of numbers used in mathematics ?
3. Draw some diagrams to illustrate the notions of union, intersection and difference of two sets.
4. The theory of probabilities uses the vocabulary and properties of sets. Explain how.