

Venn Diagrams

Math 1001

Quantitative Skills and Reasoning



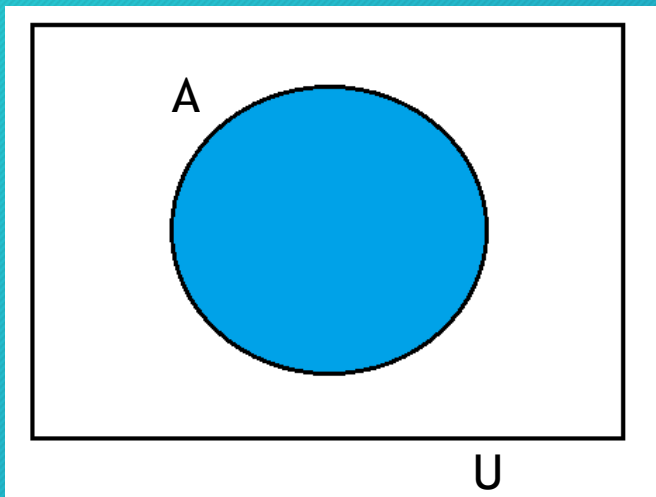
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Venn Diagrams

- The English logician John Venn (1834 - 1923) developed diagrams, which we now refer to as *Venn diagrams*, that can be used to illustrate sets and relationships between sets.
- In a Venn diagram, the universal set is represented by a rectangular region and subsets of the universal set are usually represented by oval or circular regions drawn inside the rectangle.

Venn Diagrams

- The Venn diagram below shows a universal set and one of its subsets, labeled as the set A . The size of the circle is arbitrary.
- The region outside of the circle, but inside the rectangle, represents the set A' .



What set is represented by $(A')'$?

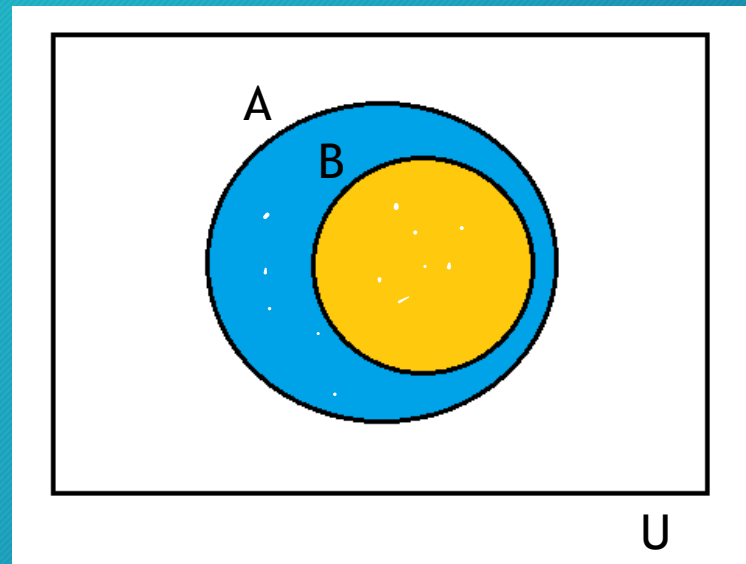
The set A' contains the elements of U that are not in A . By definition, the set $(A')'$ contains only the elements of U that are elements of A . Thus, $(A')' = A$.

Proper Subsets

- Set A is a **proper subset** of set B , denoted by $A \subset B$, if every element of A is an element of B , and $A \neq B$.
- For example:
 - $R \subset S$ and $R \subset S$
 - Let $R = \{\text{Tuesday, Thursday}\}$ and $S = \{\text{Sunday, Tuesday, Thursday}\}$. The first set, R , is a subset of the second set, S , because every element in R is also an element of S . In addition, R is a proper subset of S because $R \neq S$.
 - Let $T = \{\text{April, May}\}$ and $V = \{\text{May, April}\}$. The first set, T , is a subset of the second set, V ; however T is *not* a proper subset of V because $T = V$.

Proper Subsets

- Venn diagrams can be used to represent proper subset relationships.
- For instance, if a set B is a proper subset of A , then we illustrate this relationship as shown here.



$$B \subset A$$

Proper Subsets

- For each of the following, determine whether the first set is a proper subset of the second set:

- $\{a, l, g, m\}, \{g, m, l, a\}$

Because the two sets are equal, the first is *not* a proper subset of the second.

- W, Z

Because all of the whole numbers are integers, but there are integers that are not whole numbers (negative integers!), W is a proper subset of Z .