Basic Set Operations (union, intersection, complement) ID: MATH.1.2 Domain: Foundations & Preliminaries
Topic: Set Theory & Foundations

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[Axiomatic Set Theory]

\section*{Axiomatic Set Theory}
\subsection*{Domain} Mathematical Logic & Foundations
\subsection*{Subfield} Set Theory

\subsection*{Definition}
Axiomatic Set Theory is a formal framework for defining sets and their properties through a series of a

\subsection*{Core Principles}
\begin{itemize}
  \item Axiom of Extensionality: Two sets are equal if they have the same elements.
  \item Axiom of Pairing: For any two sets, there exists a set that contains exactly those two sets.
  \item Axiom of Union: For any set, there exists a set that contains all elements of the sets in that s
  \item Axiom of Power Set: For any set, there exists a set of all its subsets.
  \item Axiom of Infinity: There exists a set that contains the empty set and is closed under the opera
\end{itemize}

\subsection*{Key Formulas or Symbolic Representations}
\begin{align*}
  A &= \{x \mid P(x)\} \text{ (Set builder notation)} \\
  A \subseteq B &\text{ if } \forall x (x \in A \Rightarrow x \in B) \\
  \mathcal{P}(A) &\text{ (Power set of } A\text{)}
\end{align*}

\subsection*{Worked Example}
Consider the set $ A = \{1, 2, 3\} $. By the Axiom of Pairing, one can form the set $ B = \{A, \{A\}\} $

\subsection*{Common Pitfalls}
Students may confuse the Axiom of Extensionality with mere compositional understanding, mistakenly beli

\subsection*{Connections}
Axiomatic Set Theory underpins various branches of mathematics including algebra and topology. It also s

\subsection*{Further Reading}
For a thorough examination of Axiomatic Set Theory, refer to "Set Theory: An Introduction to Independenc
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