1. Use DeMorgan’s Laws to complete the equation

\[ \neg(X \cup Y) = \]

Answer:

\[ \neg(X \cup Y) = \neg X \cap \neg Y \]

2. Here is a Venn diagram. What set expression describes the shaded region?

Answer: The shaded region is \( X \cap Y \).

3. Here is another Venn diagram. What set expression describes the shaded region?

Answer: The shaded region is \( \neg X \cup Y \).

4. What is the power set of \( X \) and why is its cardinality \( 2^{|X|} \)?

Answer: The power set of \( X \) is the set of all subsets of \( X \). Since \( X \) has \( 2^n \) subsets when \( X \) contains \( n \) elements, that is, \(|X| = n\), the power set of \( X \) is \( 2^{|X|} \).